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RADIO NEWS

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September
1922

Over 175 Illustrations

Edited by H. GERNSBACK

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CUNNINGHAM

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for any type of
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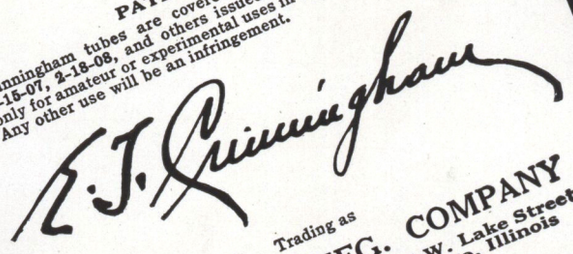

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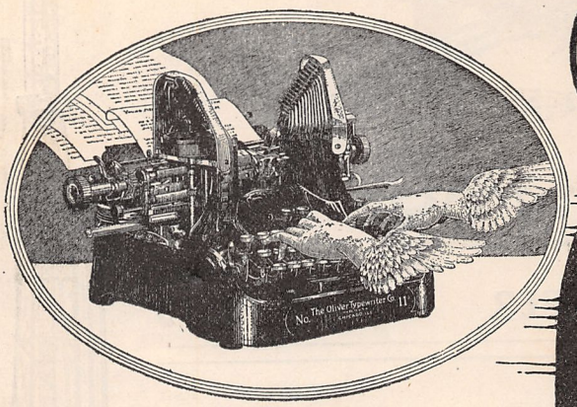

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A sensation in typewriter advancement, the climax of 26 years of development—our latest and finest model, No. 11

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Our *millionth* Oliver is a new model! It comes at a time when most people have thought that the ultimate had been reached in typewriter development. It is a contradiction of that thought, and brings many surprising advancements and betterments. Everyone who sees it is amazed.

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But Not $100

The natural conclusion would be that we would continue the custom of $100 as a standard price, or even ask more for a finer model.

But we offer this wonderful Oliver Speedster on the same plan we have recently adopted in selling the No. 9.

That is, we ship direct from the factory to the buyer, saving you the $35 that an indirect, extravagant selling system would require.

Yet, in all our 27 years experience, this is the finest typewriter we have ever built. If any typewriter is worth $100, it is this Oliver Speedster.

How We Save You $35

It is impossible to fully describe the superiorities of the new Oliver Speedster in print. You must see it and operate it to appreciate its betterments.

So we ship it to you for five days free trial, without your sending a penny in advance and without obligating you to buy.

We want you to try it in the privacy of your own office or home. Compare it with any typewriter.

We let the Oliver sell itself. You are the sole judge. Could any offer be fairer? Think how few articles dare to be sold this way!

If You Agree

that the Oliver Speedster is the finest typewriter, regardless of price, and want to own it, send us $4 after five days, then $4 per month until $65 is paid.

If you would rather pay $100 and not get this latest model, ship the Oliver Speedster back at our expense.

Throughout the trial you are your own salesman. You need not be influenced by others. This new plan has been endorsed by thousands who have bought Olivers at a saving. Remember, over 1,000,000 Olivers have been sold, both to leading businesses and individuals.

So Simple

Merely mail the coupon and it will bring EITHER this wonderful new Oliver Speedster for Free Trial, or Further Information. Check your preference.

This is a rare opportunity. Think of it—the latest model at a $35 saving! It is the ONLY offer of its kind.

THE OLIVER TYPEWRITER COMPANY
63C Oliver Typewriter Bldg.
Chicago, Ill.

Save $35

Mail Now

THE OLIVER TYPEWRITER COMPANY
63C Oliver Typewriter Bldg., Chicago, Ill.

☐ Ship me a new Oliver No. 11 Typewriter for five days free inspection. If I keep it I will pay $65 as follows: $4 at the end of trial period and then at the rate of $4 per month. The title to remain in you until fully paid for. If I make cash settlement at end of trial period I am to deduct ten per cent and remit to you $58.50. If I decide not to keep it, I will ship it back at your expense at the end of five days.

My shipping point is _____

☐ Do not send a machine until I order it. Mail me your book—"The High Cost of Typewriters — The Reason and the Remedy," the Speedster catalog and further information.

Name _____

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RADIO NEWS

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RADIO NEWS is published on the 25th of each month. There are 12 numbers per year. Subscription price is $2.50 a year in U. S. and possessions. Canada and foreign countries, $3.00 a year. U. S. coin as well as U. S. Stamps accepted (no foreign coins or stamps). Single copies, 25 cents each. A sample copy will be sent gratis on request. Checks and money orders should be drawn to order of EXPERIMENTER PUBLISHING CO., INC. If you should change your address notify us promptly, in order that copies be not miscarried or lost. No copies sent after expiration.

All communications and contributions to this journal should be addressed to Editor, RADIO NEWS, 53 Park Place, New York. Unaccepted contributions cannot be returned unless full postage has been included.

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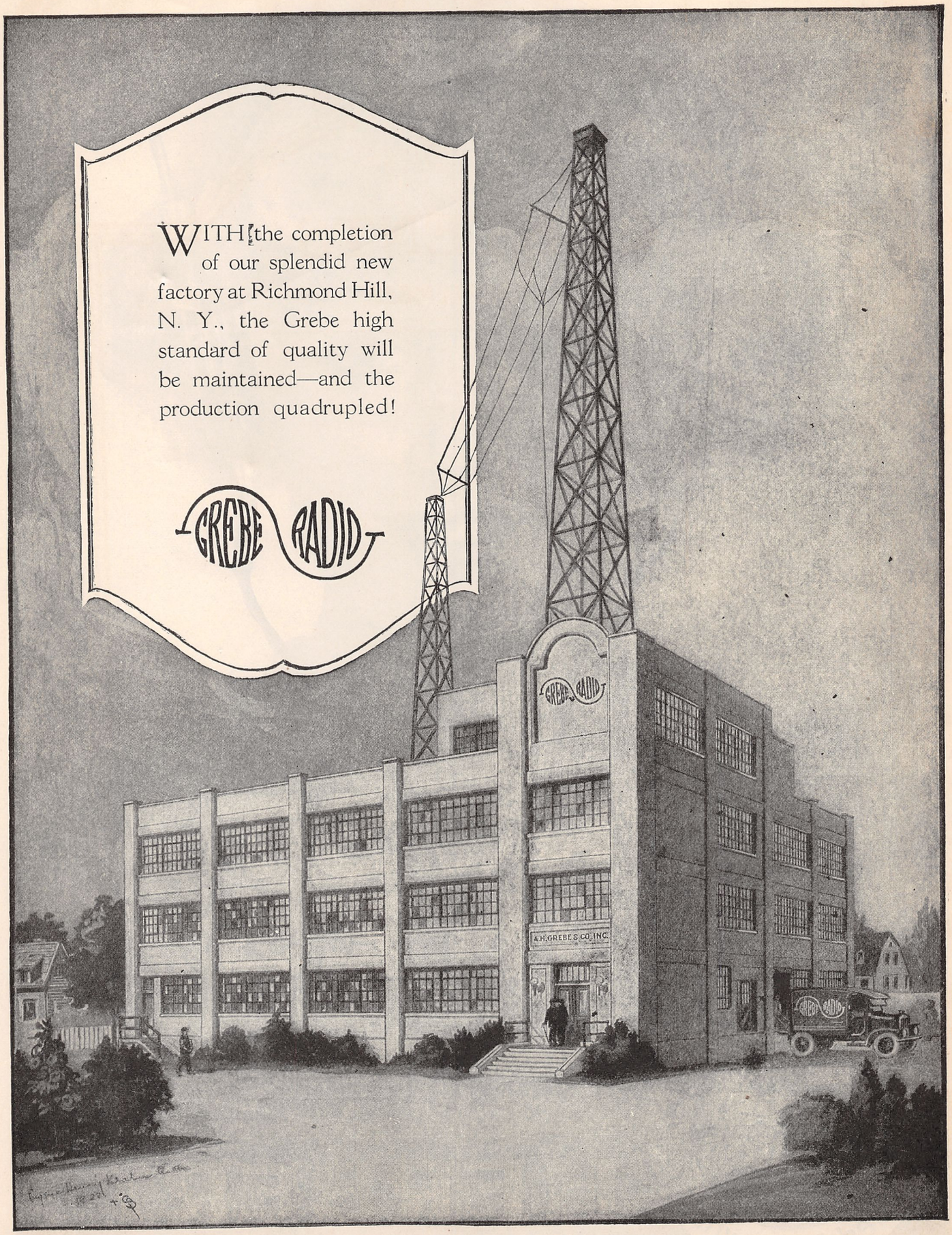
RADIO NEWS is for sale at all newsstands in the United States and Canada; also at The International News Co., Ltd., Bream's Building, London E. C. 4, England, and at Brentano's, 37 Avenue de l'Opera, Paris.

Published by EXPERIMENTER PUBLISHING CO., INC., Publishers of "Radio News" and "Science and Invention."
Publication Office: Jamaica, N. Y. Editorial and General Offices: 53 Park Place, New York City
H. GERNSBACK, President S. GERNSBACK, Treasurer R. W. DEMOTT, Secretary

General Advertising Dept., 53 Park Place, New York City. Western Advertising Representatives, Finucan & McClure, The 720 Cass Street Building, Chicago, Ill. Pacific Coast Advertising Representatives, A. J. Norris Hill Co., 1014 Hearst Building, San Francisco, Cal. Kansas City Advertising Representatives, George F. Dillon, Republic Building, Kansas City, Mo.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FONES
Best for Your
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Like Postage Stamps
FROST RADIO
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CHICAGO, ILL.
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HERBERT
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A Quality Achievement

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2000 Ohm Set

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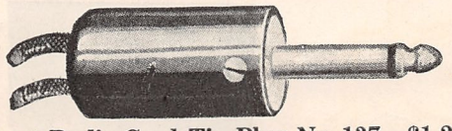
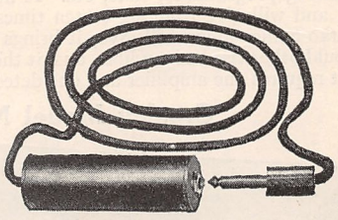
The Ideal Receivers for Use With Home Radio Receiving Sets

Frost Improved Plugs

Frost-Radio Plug No. 132—$1.00

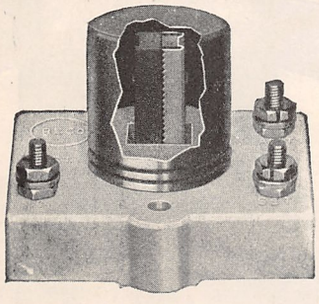


Frost-Radio Cord-Tip Plug No. 137—$1.25



Frost-Radio Extension Cord
Lengths from 10 to 100 feet

Loud speaker can be placed anywhere and connected with Radio Set with Frost-Radio Extension Cord.



FROST-RADIO PROTECTOR

Listed by Underwriters' Laboratories under April, 1922, Regulations. No interference. Never grounds. Mounts indoors. Price $1.50. Good deliveries on this approved device.

Like Postage Stamps — Used Everywhere

FROST RADIO
154 W. LAKE ST.
CHICAGO, ILL.

H. FROST

TO THE ELECTRICAL-RADIO JOBBER

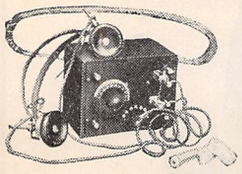
CHICAGO, ILL. U.S.A.

CROSLEY *Radio Apparatus*

BETTER—COSTS LESS

The unit outfits shown on this page are priced without tube or batteries

Crosley Crystal Receiver No. 1



This is an extremely efficient crystal detector outfit combining tapped inductance and variable condenser for tuning. Manufactured under the Pickard patents. Furnished complete as shown, with pair of standard double head phones, antenna, insulators, molded rubber dial, formica panel, Adam brown mahogany finish cabinet, complete instructions, etc. (Manufactured under Pickard patents).

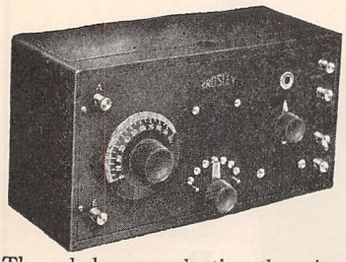
Price.....**$25.00**

Crosley Audion Detector Unit

This unit is designed to work efficiently with practically any type of tuner, and consists of socket, rheostat, grid leak and condenser, completely wired and mounted on formica panel, assembled in Adam brown mahogany finish cabinet, of a size to match up with the Crosley Crystal Receiver No. 1.

Price, complete as shown, without tube, batteries or phones.....**$7.50**

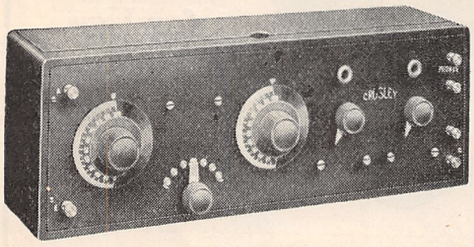
The Crosley Crystal Receiving Outfit No. 1 includes phones and antenna which are not included with the other outfits



Harko Senior No. 5

Consists of tuning element and audion detector unit mounted in neat cabinet, Adam brown mahogany finish, and many refinements over the original Harko Senior models, that have made history for themselves in the radio field.

Through large production the price is only.....**$20.00**



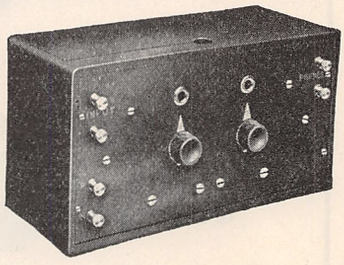
Crosley Receiver No. 6

This unit in effect combines the Harko Senior and R.F.T.A. unit. Used alone can be recommended highly to get everything that is going up to several hundred miles in the way of broadcasting programmes, code, etc. It has a range from 200 to 600 meters, and will give from six to ten times the volume of sound that the Harko Senior alone will give; it brings in stations loud and clear that would otherwise be inaudible, and at the same time is non-regenerative. It requires one amplifier and one detector tube. Price....**$30.00**

Crosley R. F. T. A. Unit

The CROSLEY RADIO FREQUENCY TUNED AMPLIFIER UNIT, R.F.T.A. for short, is described in detail elsewhere in this advertisement. It can be combined with the Harko Senior, adding one stage of tuned radio frequency. This greatly increases the range and efficiency of the Harko Senior. Price is.....**$15.00**

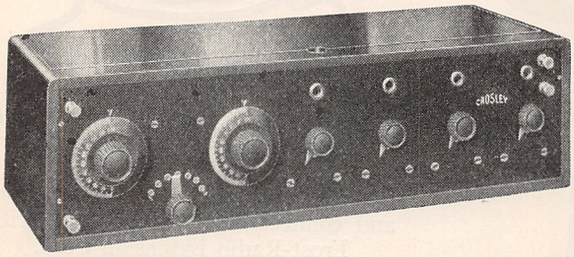
Crosley Two-Stage Audio Frequency Amplifier



This unit has been sold in large quantities for use with any type of audion detector receiver, and can be used in many combinations with Crosley or other apparatus. It amplifies signals approximately one hundred times, loud enough to be heard all over the room, in connection with any good tuner and audion detector.

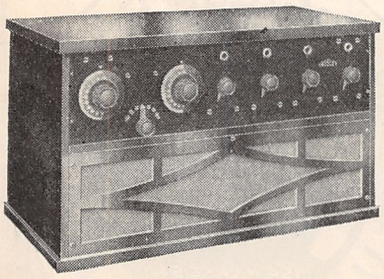
Price.....**$25.00**

Crosley Model No. X



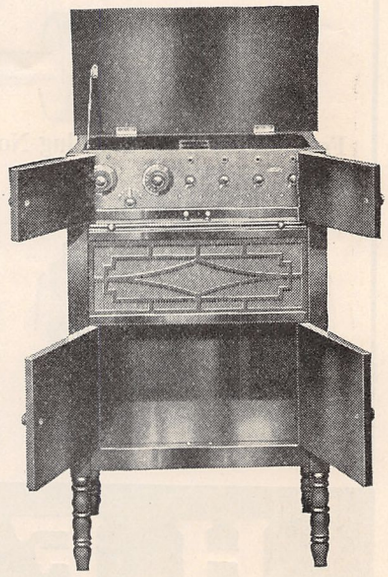
Is a combination tuning element, radio frequency tuned amplifier, audion detector and two-stage audio frequency amplifier, all mounted neatly in one cabinet, simple and easy to tune, has wonderful range and volume of sound. Price.....**$55.00**

Model No. XV



This cabinet is equipped with the model X panel, the same four-tube outfit, mounted in a special cabinet with amplifying horn incorporated therein, and can be used with head phones or single loud speaking receiver, such as the Baldwin type "C." Price of this four tube outfit is.....**$70.00**.

Crosley Model No. XX



This is the same four-tube panel as is used in model X and XV, and is complete in a floor cabinet, as shown in the illustration. In the cabinet is room for storage battery. It also is equipped with amplifying horn for use with loud speaking receiver.

Price.....**$100.00**

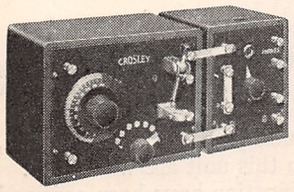
The CROSLEY MANUFACTURING CO.

CINCINNATI, O.

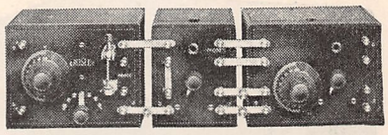
CROSLEY *Radio Apparatus*

BETTER—COSTS LESS

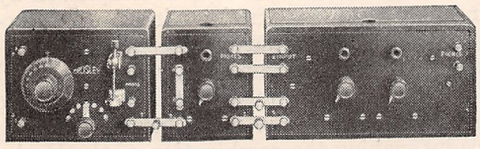
This page illustrates the flexibility of the small unit idea, and the combinations that can be built up with Crosley apparatus.



This illustration shows how it is possible to start with a Crosley Crystal Receiver No. 1, and add the Audion Detector Unit at a later time, making in effect the Harko Senior.

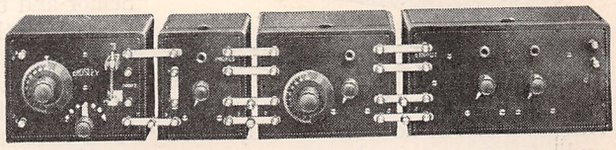


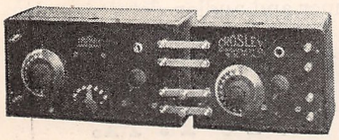
This shows how the R. F. T. A. can be added. The combination shown in the second illustration is equivalent to the Crosley Receiver No. 6.



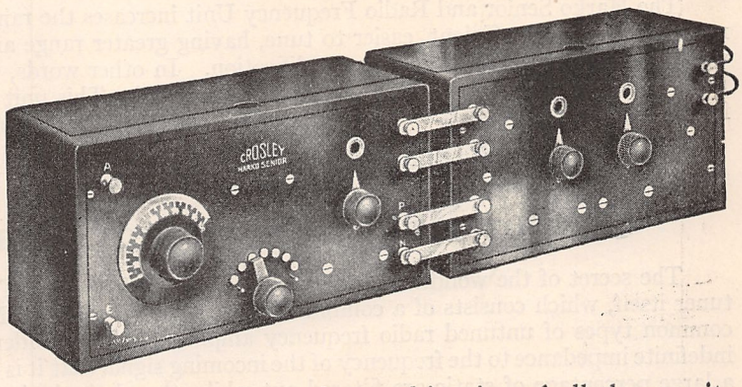
This illustration shows combination of the Crosley Receiver No. 1, Audion Detector and Two-Stage Audio Frequency Amplifier, if same is preferred to the Radio Frequency Tuned Amplifier.

Later, when desired, all four units can be combined as shown in the illustration, of the Crystal Receiving set, Audion Detector, Radio Frequency Tuned Amplifier and Two-Stage Audio Frequency Amplifier, making in effect, the Crosley Model No. X, illustrated on the opposite page.



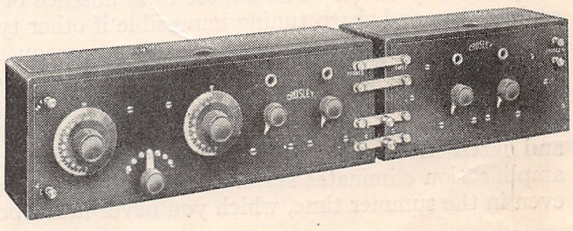


Now if the purchaser wishes to start with the Harko Senior, he can add the Radio Frequency Tuned Amplifier as illustrated, or if he prefers, he can combine the Harko Senior with the Two-Stage Audio Frequency Amplifier.



The next illustration shows the combination of all three units, which again are equivalent to the model X illustrated on the opposite page.

If the purchaser wishes to start with the Model 6, illustrated on the opposite page, he can add the Two-Stage Audio Frequency Amplifier at a later date, making a Model X. This combination is pictured below.



We believe that the unit idea has been worked out in the Crosley apparatus in a very effective manner. Efforts along this line have been made before, but never so thoroughly or completely. The idea has met with instant enthusiasm wherever shown; its popularity is already assured. The price of all units of Crosley apparatus are way below all competition. Their efficiency is unquestioned, remarkable results having been reported continually on even the simpler units. The low prices are made possible by quantity production in Crosley factories, where practically every piece and part is made, not merely assembled.

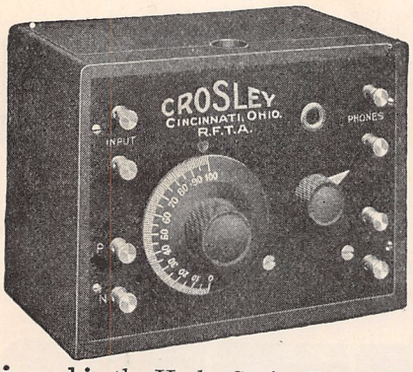
The CROSLEY MANUFACTURING CO.

Dept. R. N. 1 **CINCINNATI, O.**

CROSLEY *Radio Apparatus*

BETTER—COSTS LESS

A New Crosley Radio Triumph



This unit is designed to add one stage of radio frequency to the Harko Senior, and can be recommended most highly. The results with this unit are wonderful.

Most efforts along the lines of radio frequency amplification have been confined to the use of an untuned radio frequency transformer, working efficiently over a very narrow band of wave lengths. The R. F. T. A. being tuned works efficiently over a band of wave lengths from 200 to almost 600 meters. This is accomplished by the use of a Crosley Variable Condenser operating in conjunction with fixed inductance, both having extremely low resistance, and consequently the interaction between the capacity effect of the condenser and the inductance, as well as external body capacity effects, are reduced to a minimum, permitting easy tuning impossible with any other type of variable control of a tuned Radio Frequency Amplifying Unit. This works out in actual practice by making the combination of the Harko Senior and the Crosley R. F. T. A. very simple and easy to tune.

When this unit is used in connection with the Harko Senior, an amplifier tube is used in the Harko Senior Unit with the grid leak and condenser bridged or short circuited. The detector tube is then placed in the radio frequency unit, thus this new unit contains the radio frequency tuner and the detector tube and its control.

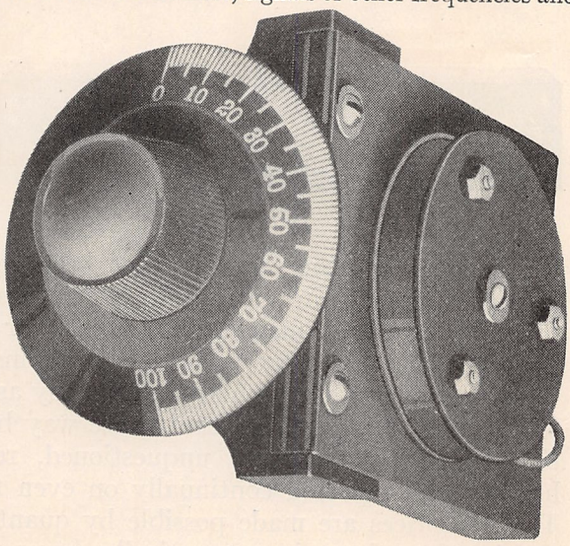
This unit can be added to any of the new type Harko Senior No. V units, and the Crosley Two-Step Audio Frequency Amplifier can be added if desired, making a four-tube set, consisting of one stage of radio frequency, detector and two stages of audio frequency.

The Harko Senior and Radio Frequency Unit increases the range and volume of the Harko Senior alone at least ten times, making it far more efficient, easier to tune, having greater range and volume than any type of tuner that we know of coupled with one stage of audio frequency amplification. In other words, the combination of the Harko Senior and Radio Frequency Unit are superior to any two-tube set that we know of. This unit also has the advantage of sharper tuning, eliminating interference, and it reduces static to a minimum. It can be used with other types of combination tuner and audion detectors.

Price, without Tube or Batteries..... **$15.00**

Crosley Radio Frequency Amplifier Tuner, R. F. T. A.

The secret of the wonderful success of the Radio Frequency Tuned Amplifier, illustrated and described above, is in the tuner itself, which consists of a combined inductance and Crosley Model "B" Variable Condenser. This is used in place of the common types of untuned radio frequency amplifiers. The condenser is tuned so that its relation with the coil forms an indefinite impedance to the frequency of the incoming signal that it is desired to tune. As a result, signals of other frequencies and a large percentage of static are filtered out while the desired signal is impressed, multiplied by the amplification constant of the first tube, on the grid of the detector tube, thus increasing the signal audibility and makes possible the hearing of signals which would normally not be heard. It is a well recognized fact that any untuned type of radio frequency amplifier is very limited as to its efficient working range. While the tuned impedance principle of radio frequency amplification is not new, its practical application is made possible from the combination of the inductance with the Crosley Variable Condenser.



Crosley variable condensers are recognized as being superior to other types for at least two reasons, low internal resistance and the minimum of body capacity effect. The almost total absence of body capacity effect enables ease and sharp tuning impossible if other types of Variable Condensers were used for the purpose. As a consequence, this unit enables the operator easily and sharply to tune the signals over a range of from 200 to 600 meters. We most highly recommend this unit to those who desire to utilize radio frequency amplification. We furnish drawings and instructions for its use. This method of tuned radio frequency amplification eliminates static to a large degree, and brings in stations, even in the summer time, which you never heard before.

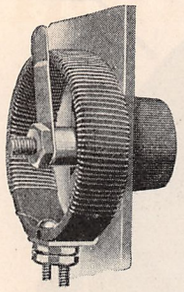
Price, as illustrated, complete with molded knob, dial ready for panel mounting, with directions, is..... **$4.00**

The CROSLEY MANUFACTURING CO.

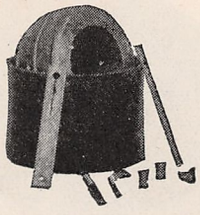
CINCINNATI, O.

CROSLEY *Radio Apparatus*

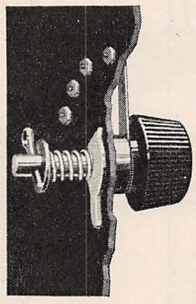
BETTER—COSTS LESS



Crosley Rheostats permit exceptionally accurate and delicate variations of filament current. They can be mounted on any thickness of panel up to ⅜ ins. Resistance 6 ohms and will carry 1 ampere without heating. For amplifying tubes or detectors. Price, **60c.**

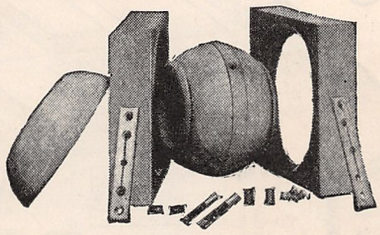


The Crosley Variocoupler parts consist of a formica tube, rotor and the necessary hardware for complete assembly. All parts are made with great accuracy and can be assembled perfectly and neatly. Rotor diameter is 3¼ ins. Tube lengths, 2½ ins. Tube diameter, 3 3/16 ins. All parts, complete with necessary hardware, $1.50. Also furnished wound and assembled, complete with knob and dial, **$3.00.**



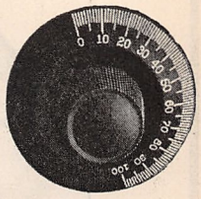
Crosley Tap Switches

The unique Crosley designs of these switches include a lug to which buss wire may be soldered. Knob is tapered, extremely neat in appearance and switch arm is under constant and permanent tension. Price, **30c.**



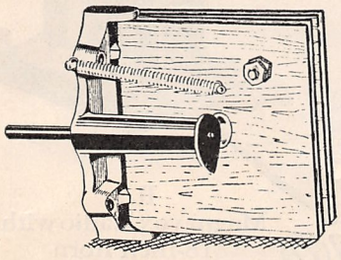
Crosley Variometer Parts

Made in great quantities in our large wood-working factory. Crosley Variometer parts are accurate, of neat design and very moderately priced. Stator and rotor forms are furnished complete with all necessary hardware for assembly according to individual ideas. Made of poplar wood and nicely shellaced. **$1.50**; winding form, **30c.**



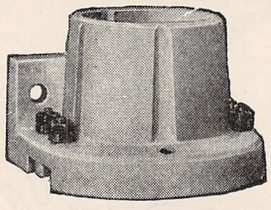
Crosley Knob and Dial

Moulded in one piece. Black with white-filled letters. ¼-in. standard shaft fitting 3/16 optional. Price, **40c.**



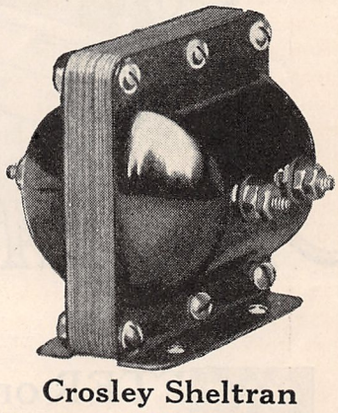
Model B

Crosley Variable Condensers because of their quantity production and simple construction are almost unbelievable at the price. Not alone this but substantiate this claim by laboratory tests in one of the country's leading universities and in practical support of this, thousands of users through the United States attest their efficiency and value. Model "B" condenser, 0005 mf. capacity die cast frame, laminated wood panels. Price, without knob and dial, **$1.75.**



Crosley V. T. Socket

A practically unbreakable socket of porcelain which because of its high dielectric value is the most desirable socket material. Not only does it eliminate possible ground hums but permits soldering of wire connections. The Bayonet slot is reinforced and the contacts are nickeled and positive. It is designed for base or panel mounting and at twice the price is a remarkable piece of radio apparatus. Crosley "Better — Costs Less." New Price, **50c.**



Crosley Sheltran

In this piece of Crosley apparatus we have a completely shielded transformer, a feature to be sought in this important radio part. Its design has proven highly efficient in obtaining maximum amplification from modern vacuum tubes. Its ratio is 1 to 9. Net weight, 12½ ozs. Area, 1¼ x 2½ ins. Price, **$4.00.**

The CROSLEY MANUFACTURING CO.

CINCINNATI, O.

No Wireless Receiving Set is complete without

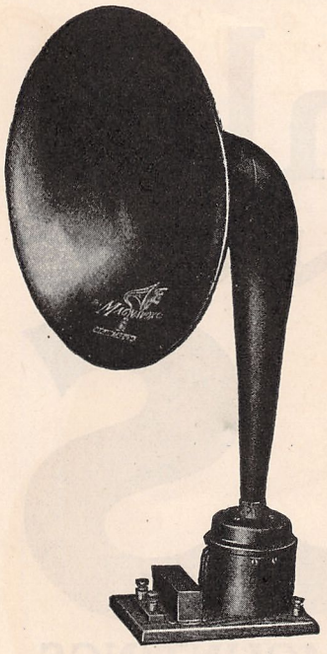
The MAGNAVOX Radio

R-2
Magnavox Radio with 18-inch horn

For those who wish the utmost in amplifying power; for large audiences, dance halls, etc. Requires only .6 of an ampere for the field.

Price $85.00

AFTER once using a Magnavox Radio you would no more go back to the telephone headset than you would exchange your electric light for a feeble tallow candle. With the Magnavox Radio you hear every wireless program at its best—your receiving set only brings the message while Magnavox Radio tells it clearly and in



R-3
Magnavox Radio with 14-inch horn

The ideal instrument for use in homes, offices, amateur stations, etc. Requires one ampere field current from your filament battery.

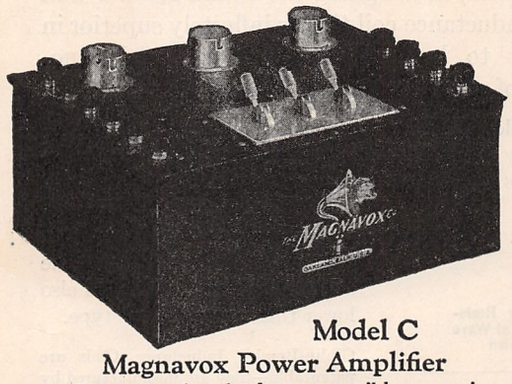
Price $45.00

volume ample for dances, parties and other entertainment.

The Magnavox Company have been pioneers in the development of scientific devices for sound amplification.

Consequently the new radio situation created by the marvelous spread of broadcasting facilities has only served to give additional prominence to the basic importance of Magnavox products.

When you purchase a Magnavox Radio or Magnavox Power Amplifier you possess an instrument of the very highest quality and efficiency. The Magnavox Radio and Magnavox Power Amplifier may be had of good dealers everywhere.



Model C
Magnavox Power Amplifier

Insures getting the largest possible power input for the Magnavox Radio. Can be used with any "B" battery voltage which the power tube may require for best amplification.

AC-2-C, 2-Stage - - - $80.00
AC-3-C, 3-Stage - - - 110.00

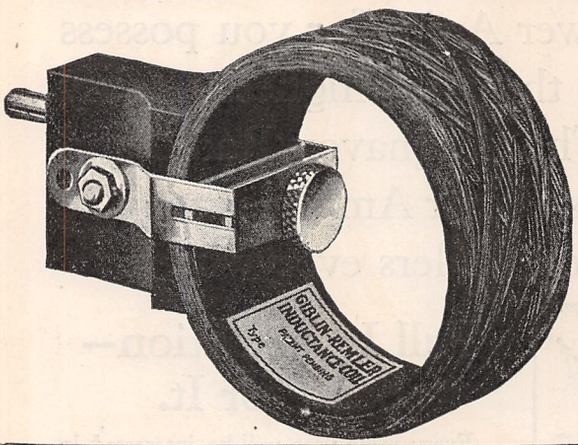
Full Information—Send for It.

Every radio user will be interested in reading this new folder on the Magnavox Radio and Magnavox Power Amplifier. *Send for a copy today.*

THE MAGNAVOX COMPANY
Home Office and Factory:
Oakland, California
New York Office: 370 Seventh Ave.

MAGNAVOX Radio
The Reproducer Supreme

Giblin-Remler
INDUCTANCE
COILS
INTERCHANGEABLE WITH ALL COIL MOUNTINGS



The new Giblin-Remler Coil has achieved a remarkable success. Placed on the market thirty days ago, it has already achieved enthusiastic response from all sections of the country.

Thomas P. Giblin, in designing the Giblin-Remler Coil has built an inductance coil that is infinitely superior in every respect to both the Honeycomb and Duo-Lateral Coils of which he is also the originator.

The Giblin-Remler Coil is equally effective on all wave lengths—the self capacity is far less than any previous compact inductance—this gives selectivity and sharp tuning for a given coil which is of special advantage to the amateur who usually has an antenna of low capacity. The high frequency resistance is also lower than any previous type.

Type and Number of Turns, Mounted	Price, Mounted	Type and Number of Turns, Unmounted	Price, Unmounted	Inductance in Millihenrys at 1000 cycles Accuracy ½%	Natural Wave Length in Meters, Accuracy ½%	Distributed Capacity, in micro-micro-farads, Accuracy 1%	Wave Length Range in Meters using Condenser of .001 max. and .00004 mfd. min.		High Frequency Resistance in Ohms at Wave Length Shown			
							Minimum	Maximum	200	500	1000	2000
RG 20M	1.50	RG 20U	.70	.030	39	14.3	63	334	.....	1.1	.....	.....
RG 25M	1.50	RG 25U	.70	.041	47	15.2	75	389	.....	1.5	.....	.....
RG 35M	1.50	RG 35U	.70	.083	87	25.4	128	550	.....	3.5	.....	.....
RG 50M	1.60	RG 50U	.80	.169	114	21.6	185	785	.....	8.8	4.4	.....
RG 75M	1.65	RG 75U	.85	.377	163	19.8	266	1170	.....	28.3	12.1	6.2
RG 100M	1.70	RG 100U	.90	.666	217	19.9	358	1550	.....	80.3	26.8	12.6
									1000	2000	5000	10000
RG 150M	1.75	RG 150U	.95	1.503	281	14.8	512	2320	69.8	23.8	7.1	.....
RG 200M	1.80	RG 200U	1.00	2.68	374	14.7	690	3110	.....	50.6	12.5	.....
RG 250M	1.90	RG 250U	1.10	4.20	424	12.1	860	3880	.....	87.5	19.9	.....
RG 300M	2.00	RG 300U	1.20	6.11	494	11.2	1030	4680	.....	141	29.3	13.8
RG 400M	2.10	RG 400U	1.30	11.04	618	9.7	1380	6300	.....	.....	54.6	22.3
RG 500M	2.30	RG 500U	1.50	17.50	747	9.0	1730	7900	.....	.....	93.1	34.9
									2000	5000	10000	20000
RG 600M	2.40	RG 600U	1.60	29.2	1024	10.1	2260	10250	.....	111	43.8	.....
RG 750M	2.65	RG 750U	1.85	39.0	1249	11.3	2660	11850	.....	.....	64	.....
RG1000M	3.40	RG1000U	2.50	71.6	1620	10.3	3570	16000	.....	.....	123	.....
RG1250M	3.80	RG1250U	2.90	108.0	1930	9.7	4380	19700	.....	.....	.....	.....
RG1500M	4.40	RG1500U	3.50	159.8	2300	9.3	5300	23800	.....	.....	.....	.....

These tests have been made by Robert F. Field of Cruft High Tension Electrical Laboratory, Harvard University, Cambridge, Mass.

Giblin-Remler Inductance Coils are patentable—they are manufactured by patented machinery. This protects you and insures your receiving the genuine Giblin-Remler Coils.

If you cannot secure Giblin-Remler Inductance Coils from your dealer send to us direct. Order now as these coils will help you get truly wonderful results from your set.

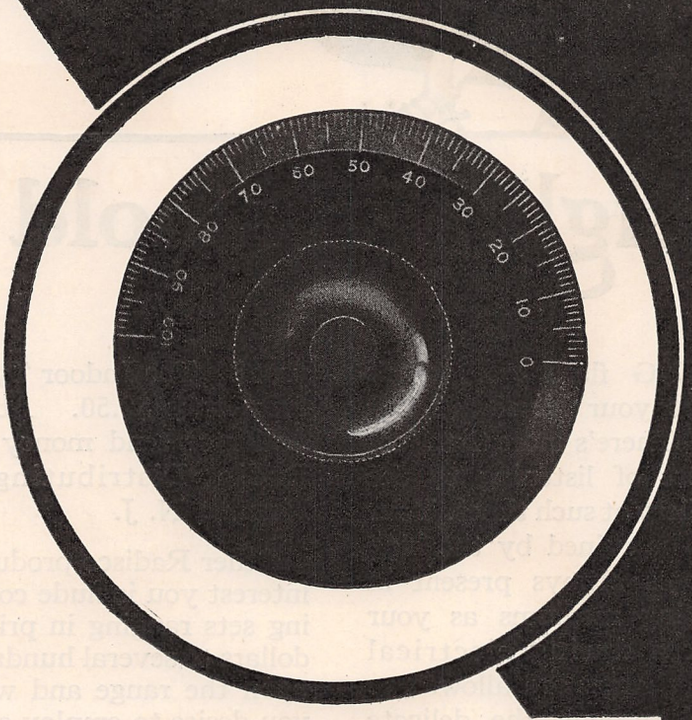
REMLER
RADIO MFG. CO.
E. T. CUNNINGHAM
General Manager

248 First Street
San Francisco, Calif.

154 W. Lake Street
Chicago, Ill.

REMLER

APPARATUS THAT RADIATES QUALITY



3 inch Bakelite DIAL

with knob and bushing

Type No. 100

75c

In ordering please specify $\frac{3}{16}$″ or $\frac{1}{4}$″ shaft.

The dial and knob are both of molded bakelite will not warp or discolor.

Buy REMLER Quality

Here is a Remler Dial molded from genuine bakelite that will meet your most exacting requirements for accuracy and good looks.

This Remler 3-inch bevel-edged dial will not warp or discolor—it has a highly polished surface—the engraving is filled with white enamel which will not wear off—the 100 division scale is arranged for clockwise rotation.

The knob made from molded bakelite is $1\frac{3}{8}$ inches in diameter—the bushing is drilled for $\frac{3}{16}$ or $\frac{1}{4}$ inch shaft, the set screw passing through both knob and bushing. The remarkable quality built in this Remler item—the extreme care used in manufacturing insures a dial that is absolutely true running at all times.

REMLER RADIO MFG. COMPANY

248 FIRST STREET
San Francisco, Cal.

E. T. CUNNINGHAM
General Manager

154 W. LAKE STREET
Chicago, Ill.

A Lightning hold up

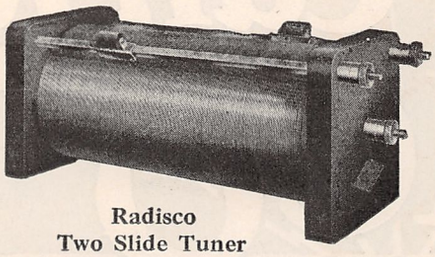
A BLINDING flash . . . crash . . . . not your house . . . but pretty close. There's more than just the discomfort of listening to the heavenly artillery at such times. Your radio set can be ruined by the high induced charges always present in such conducting mediums as your antenna wires during electrical storms, if the charges are allowed to go to ground through the delicate instrument.

A Radisco Lightning Arrester holds up Old Man Lightning and sidetracks these high induced charges peacefully to earth. You can take your choice of two different types. The Outdoor Type sells for $3.00 and is weather-proof. The Indoor Type of Radisco costs only $2.50. At your nearest dealer or send money direct to the Radio Distributing Company, Newark, N. J.

Other Radisco products which will interest you include complete receiving sets ranging in price from a few dollars to several hundreds depending upon the range and whether or not you desire to employ a loud speaker. Also parts for improving your sets including amplifying transformers, vario-couplers, variometers, variable condensers, switch sets, dials, binding posts, detector and amplifier units, etc. *Send for our new catalog. A charge of 10 cents is made to cover mailing expense.*

RADIO DISTRIBUTING COMPANY
NEWARK, N. J.

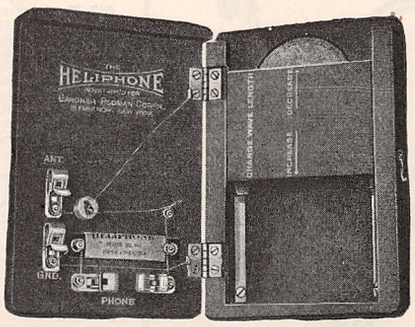
RADISCO
LIGHTNING ARRESTER



Radisco
Two Slide Tuner

HERE'S a rugged, well built and unusually efficient tuner. Coil is 10 inches long by 4 inches in diameter. Ends are of highly polished bakelite. Range from 150 to 700 meters.

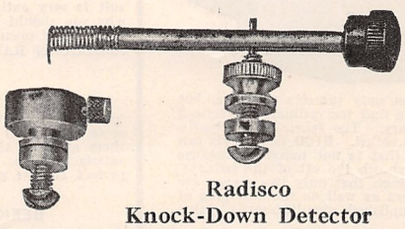
Catalog No. 44 Price $4.00



Pocket Receiver

HERE is the most convenient small set you can buy. Fits the coat pocket. Excellent for camping or hiking. Approximate range, 30 miles—permits sharp tuning. With the exception of phones and aerial this set is complete in every detail. A remarkable value.

Catalog No. 38 Price $5.00



Radisco
Knock-Down Detector

ONE of the finest and most serviceable detectors on the market. Adjusting rod, with novel universal joint, permits free but positive adjustment over entire surface of crystal. All parts heavily nickeled.

Catalog No. 449 Price 75c

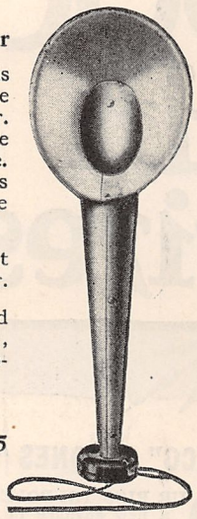
Radisco
Stramcy Horn and Coupler

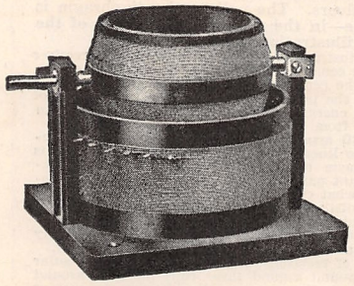
NO DISTORTION here: This Horn and Coupler make a simple but very efficient loud speaker. Horn is 20 inches high and made of two layers of special fibre. Air space between layers acts as a deadener for false vibrations.

Here is a convenient, efficient and economical loud speaker.

The Coupler alone may be used as an adapter for Victor, Columbia and other phonographs as well as the horn.

Horn, Catalog No. 84
Price 95c; with Coupler $1.55
Coupler, Catalog No. 86
Price 60c





Radisco
Variocoupler

THIS moulded variocoupler has been the standard of the Radio Distributing Company for years. The moulded supporting columns have brass bearings. Positive contact is assured by phosphor bronze brushes at each bearing. Wire is insulated with special black varnish to protect from moisture. Wave length range with suitable condensers, 150 to 700 meters.

Catalog No. 400 Price $6.50

Four can listen with a
Phonoscope

EXTRA headphones are unnecessary. The Phonoscope permits four people to "listen in" for $5.00. (Four sets of phones cost from $20.00 to $60.00.) The phonoscope does not cause distortion in tone quality; voice and music alike are reproduced clearly. Exactly what you need for entertaining your friends.

Catalog No. 83 Price $5.00

RADISCO
RADIO PRODUCTS

$300 in Prizes

What Can You RICO

TRADE MARK REG.

"RICO" 'PHONES "talk for themselves"

OUR RICO TRI-POLE double head 'phones mark a new advance in telephone receivers. They are built on a radically different plan from all other receivers. The pull on the diaphragm is where it should be—**in the mathematical center of the diaphragm.** Our illustration makes this clear.

In one of our illustrations we show the ordinary receiver where the two poles come together somewhere near the center. They are never in the center of the diaphragm. It should be remembered that if the pull is in the mathematical center of the diaphragm, less energy is necessary to pull it down than if the pull is away from the center.

Now note the **RICO** arrangement. The pull is in the mathematical center. The lines of force of the magnetic circuit is through the diaphragm exactly as with any other type receiver. The important part, however,—the pull in the mathematical center,—is what gives **RICO** 'phones a distinct feature.

There are three distinct poles in the **RICO** receiver. The center is the one pole while the two end yokes form the second pole. This gives a well balanced receiver that is very rugged in design, and that does not get out of order easily.

In the usual type of receivers the pole pieces are rectangular and the fine wire wound around these coils must go around corners. The nearer to these corners, the sharper the corners will be. This is the inherent weakness of all such receivers. **RICO** receivers are less apt to burn out than the usual type.

By having a single central spool with a heavy core, we do away with another important bugaboo in the radio receiver, technically called "freeze." Unless the receiver is a very expensive one, and of a high grade type, the two pole-pieces will not always be true, but due to temperature changes, screws unlocosening, etc., the pole-pieces may move a few thousandths of an inch. That is enough to bring the diaphragm in contact with one or both pole pieces, and the "freezing" occurs. This cannot happen in the **RICO** receiver because only one central pole is used, the construction of the parts being such that it cannot move.

You may pick up any pair of **RICO** receivers and they will all give exactly the same tone. The sound will be the same in one ear as in the other. In the usual type of receiver there are two spools wound with wire. Unless the amount of wire is exactly the same on each spool it may easily be seen that one pole-piece will attract the diaphragm more than the other, or vice versa. **Distortion is the result.**

This can never happen with the **RICO** receiver, because only one pole-piece is used with a single winding, hence 100 per cent. correct pull in the mathematical center of the diaphragm.

Whether used for broadcast radio telephone work, or long distance radio telegraphy, **RICO** receivers are especially sensitive for long distance work where many other receivers will not bring in the sound clearly and perhaps not at all.

OUTSTANDING MECHANICAL FEATURES

Rugged in design, **RICO** receivers have been made with a special eye toward lightness. They are of great stability and the adjustment of the diaphragm cannot change.

Aluminum shells on account of their lightness are used. The caps are of a hard rubber composition. A novel feature are the diaphragms, which do not rust like the usual tin type. Our diaphragms are sherardized, that is, they are alloyed with a thin coating of zinc. Perspiration which **always** condenses on a diaphragm from the heat of the ear, therefore, will not rust ours.

The magnets used in our **RICO** receivers are of the best tungsten steel procurable. This magnet is very powerful and due to its great mass attracts the diaphragm with maximum force.

Our headband is an outstanding feature. It is the only headband which is adjustable both ways. The headband may be opened or closed to fit various shaped heads. The two bands can be drawn close together or placed far apart. Many operators like to have one of the bands on the back of the head, and one going over the center. This can be readily accomplished with our headband. We use exclusively a soft rubber pure gum tube which not only protects the wire, but protects the wearer as well. We find the ordinary mercerized cotton braided bands not sanitary. The fabric soon absorbs the oil of the hair and becomes soiled. **RICO** headbands can be washed if desired, although that is not necessary because the pure gum rubber does not absorb the oil of the hair.

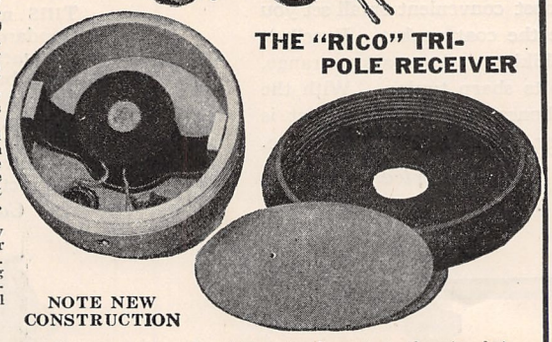
The headband adjustment is such that only two screws are used. The height of the receivers as well as the clamping of the two bands are both accomplished simultaneously. One adjustment only is necessary.

Standard resistances, 2,000 and 3,000 ohms. Receivers may be manufactured to order up to 6,000 ohms if desired, or as low as 5 ohms.

We manufacture regularly double head sets as well as single head sets. The double head sets are shown in the illustration. The single head set has only one 'phone with the headband made in such a manner as to attach firmly to the head. We furnish a five-foot cord. The single receivers listed mean only one receiver, minus the headband and cord.

This company can manufacture 'phones to any resistance, and will be glad to quote prices upon request.

THE "RICO" TRI-POLE RECEIVER



NOTE NEW CONSTRUCTION

TESTIMONIALS

MUSKOGEE ELECTRIC COMPANY,
Muskogee, Okla.

Gentlemen:—I consider your **RICO** Tri-pole receivers **superior to any 2000 ohm receiver** we have ever carried in stock. This I consider due largely to the extra magnetic poles which makes it more sensitive to the vibrations which is so essential to all Radio apparatus.
M. A. Screechfield.

F. B. WORLEY,
617 Montgomery St., San Francisco, Cal.

Gentlemen: After having given your **RICO** 'Phones a thorough trial, I must say that I am thoroughly satisfied with them, and find that my Radiophone is much improved with their use. I have compared them with other 'phones and **consider them better than any I have as yet tried.** Another very strong point is that they are comfortable to wear while "listening-in."—F. B. WORLEY.

WILSON,
The Stationer and Bookman. Seattle, Wash.

Gentlemen:—We are pleased to state that your **RICO Tri-Pole 'phone is the best 'phone we have yet had experience with, bar none.** The prices are right, construction is the finest. We are especially pleased to see the rubber tube covering the head band. This makes the user appreciate a 'phone which is comfortable. **It is the most sensitive 'phone** that we have had the experience in using and we highly recommend it.
ARCHWAY BOOK STORE,
By J. W. Wilson,
Corner 3d Pike, Seattle, Wash.

DIXIE MANUFACTURING CO.,
Union City, Ga.

Gentlemen:—We referred your 'phone to the "C. G. Drake Radio Service of Atlanta, Ga.," and it was tried out by them. **We are informed it gave the best of satisfaction.** The writer is interested in this company, and you will no doubt hear from them soon. We inclose our check to pay for the sample.
DIXIE MANUFACTURING CO.,
C. H. Gullatt, Pres.

AMERICAN RADIO & RESEARCH CORP.,
Medford Hillside, Mass.

Gentlemen:—We found an opportunity to test this 'phone shortly before forwarding same, and our engineers report that the **result is very satisfactory.** We see no reason why you should not meet with a good reception in the open market.
AMERICAN RADIO & RESEARCH CORP.,
H. D. Murphy.

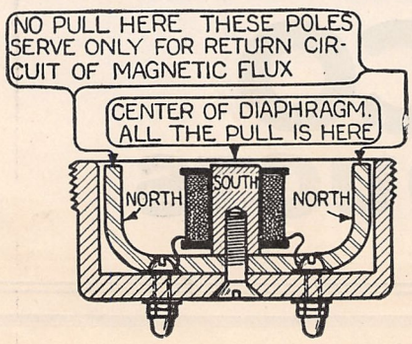
Dover, Del.

Gentlemen:—I received **RICO** Tri-pole 'phones ordered from you. Will say **they are some 'phones. I never saw anything to equal them** at twice the price of them. They give satisfaction in every way and complete a perfect Receiving Set. ALOIS TAYLOR,
Route A, Dover, Del.

BERKMAN & SMITH,
Selling Agents.
715 Trust Building. Dallas, Texas

Gentlemen: The sample set of **RICO** Tri-pole 'phones was received. After looking at the set and giving it a thorough test, **we are convinced of its merits** and firmly believe that we can secure a very nice volume of business for you on this item.
BERKMAN & SMITH,
(Signed) H. E. Smith.

"RICO" CONSTRUCTION



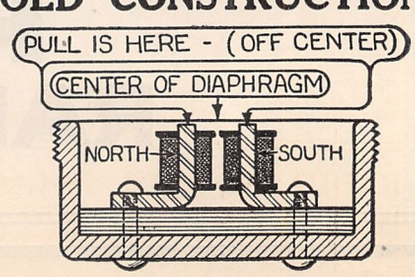
PRICE LIST

No. 20	2000 ohms	Double Head Set	$6.50
No. 30	3000 ohms	Double Head Set	7.50
No. 40	4000 ohms	Double Head Set	9.50
No. 50	5000 ohms	Double Head Set	12.50
No. 60	6000 ohms	Double Head Set	15.00
No. 10	1000 ohms	Single Head Set	4.00
No. 15	1500 ohms	Single Head Set	4.50
No. 75	75 ohms	Double Head Set	6.50
No. 5	5 ohms	Double Head Set	6.50
No. 2	1000 ohms	Receiver only	2.50
No. 3	1500 ohms	Receiver only	3.00
No. 05	5 ohms	Receiver only	2.50

ORDER FROM YOUR DEALER. If he cannot supply you, order from us.

RADIO INDUSTRIES CORPORATION
131 Duane Street New York

OLD CONSTRUCTION



Do With RECEIVERS

$300 in Prizes

RICO RECEIVER CONTEST

The Radio Industries Corporation, in order to put their **RICO** Receivers into the hands of every radio "fan" in the country, have decided to make a prize offer of $300.00 in gold. At the present time the **RICO** Receivers are one of the fastest selling telephones in the country. We are, however, not satisfied with this, and it is our aim to have every amateur own a set of these Receivers. In order to do so, we are willing to spend a little money to show just how good and how really wonderful this Receiver is.

The idea of this prize contest is very simple. We are going to give prizes to those who originate some new idea or a new stunt with **RICO** Receivers. In order to make plain what we want, we have shown four examples on this page.

Figure 1 shows how one stunt is accomplished. You will see that it is simplicity itself, as well as novel.

It shows a horn made of wood to which a **RICO** Head Set is attached. The height of the horn is exactly in proportion to the head set shown. Try it. It works admirably.

Figure 2 shows how a single **RICO** Receiver can be made to fit any phonograph. The **RICO** Receiver composition cap is placed in a horizontal position; then a stick of wood, around which paper is wound, is inserted into the hole of the cap, so that no sealing compound will run into the hole. Next a form is made, either of paper, cardboard or plaster of Paris, and into this form sealing wax is poured, which will produce the shape as shown. When cooled, the form is taken apart, the stick pulled out, and the paper unrolled, leaving a central hole all the way down. A large piece of rubber tubing is then slipped over a small part of the sealing wax, and we now have a coupler that can be attached to any phonograph, no matter what the size, due to the flexibility of the rubber tubing. We have tried this scheme and it works well.

If you do not wish to spoil the cap on your receiver, you can secure additional caps for 25c from us.

Figure 3 shows how an Amplifier can be made from a 1000-ohm **RICO** Receiver. The central core of the Receiver is hollowed out to form a half cup. It is then carefully polished to bring out a high polish, and an insulating washer, which can be made of a good grade of bond paper, is then placed on top of the receiver edge. On top of this comes the regular diaphragm. This diaphragm can be used as it is, but it would be better to have it gold-plated on one side, as we find that this gives better results, bringing out the sounds much more clearly. Inside of the hollow cup we place the largest size of polished carbon grains that can be secured. These can be bought from most electrical specialty houses. When the diaphragm is clamped down it is impossible for the carbon grains to fall out, because they are much larger than the small space left between the diaphragm and the top of the core. One connection is made from the receiver case, and another connection from the edge of the diaphgram. This can be readily accomplished by filing, or by means of a hack saw, cutting a slot into the cap to expose the edge of the diaphragm. A thin wire, about No. 24 B&S gauge, is then soldered to the diaphragm. After clamping down the cap tightly we have one of the most sensitive microphone Amplifiers imaginable. The idea is that there is nothing to impede the vibrations of the diaphragm except the carbon grains. The slightest disturbance of the diaphragm, which you could not hear with your ears, will have its effect upon the carbon-grain microphone, and if we now connect the two wires in series with a 5-ohm **RICO** Receiver and a 2-cell, 3-volt battery, the **RICO** 5-ohm Receiver will talk very loudly. It can be improved by having a horn placed upon the 5-ohm Receiver, when we shall have a real effective loud-speaker. **This amplifier works with a crystal detector.** The position shown in our illustration is not the correct one. The instrument should be set **vertically** for best results. By placing it in a box and packing around it soft, absorbent cotton, outside noises, vibrations, etc., will not affect the amplifier, and good results will be had.

A similar scheme is shown in illustration 4, where a microphone is formed by means of a needle soldered to the center of the diaphragm. The bottom part of the needle is inserted in a carbon cup (made by drilling a 1/16" hole in a piece of carbon), containing a small quantity of carbon grains. It is evident that the slightest disturbance of the diaphragm will make a big deflecton at the lower end of the needle, due to a lever action, and the carbon grains will be disturbed. The battery B is about 3 volts. The induced current, which is then set up in the telephone induction coil, will make the 5-ohm **RICO** Receiver talk very loudly, as shown. This scheme is subject to slight modifications, best found out by the experimenter. The scheme works well even by using only the needle, the latter touching a carbon block.

These are the sort of ideas that are going to win prizes. We invite radio "fans" to secure a set of **RICO** Receivers and experiment with them, to try to find some new, useful wrinkle or some new idea as shown in our four examples. The best ideas will be awarded prizes.

It is quite necessary, in order for anyone to win a prize, that he secure either a set of **RICO** Receivers or a single **RICO** Receiver, shown on our price list on the preceding page. It makes no difference whether a complete set is bought or a single Receiver.

No prizes will be given for ideas only, and in order to protect the contestants it is necessary for them to advise us in their manuscripts where the **RICO** Receiver was purchased, and a receipt for the purchase should be enclosed with the manuscript if possible.

It is not essential that a model be submitted. A good photograph will be accepted by us, but if it becomes necessary, in order to convince ourselves that the idea is practical, we may wish to call for the model, which, of course, will be returned as soon as the tests have been completed.

It should be understood that the highest prizes will be awarded to those who show the greatest amount of originality and novelty.

When sending manuscripts, be sure to confine them to 500 words or less. Do not submit penciled matter.

The prizes for this contest will be paid immediately at the close of this contest, viz., October 15th. Checks will be mailed to the winners on or before October 20th, 1922. We shall also make an announcement of the prize winners and the prize-winning ideas in the January, 1923, issue of this magazine.

This prize contest may be participated in by any and all individuals. If two contestants submit the identical prize-winning apparatus or idea, the prize will be paid to each of the two contestants.

Address all models, letters, and manuscripts, etc., to Mr. B. Gould, Director of Sales, in care of this company.

Six Prizes, $300

First Prize	**$100 in Gold**
Second Prize	**$75 in Gold**
Third Prize	**$50 in Gold**
Fourth, Fifth and Sixth Prizes (each)	**$25 in Gold**

TESTIMONIALS

CAPITAL RADIO COMPANY,
2041 K Street, Lincoln, Nebraska.

Gentlemen:—In regard to your **RICO** tri-pole 'phones we wish to state that we have tested them out in our laboratory, and find them equal in sensitiveness, and in several instances **far superior** to 'phones selling at higher prices. We also wish to commend you on the construction of the headband, which is exceedingly comfortable.

CAPITAL RADIO COMPANY,
Paul C. Rohwer, F. Bradden.

PHILIPSBURG FOUNDRY & MACHINERY COMPANY, Philipsburg, Penna.

Gentlemen:—Relative to the **RICO** Tri-pole 'phone, which we received from you sometime ago, please be advised as follows: We have found this 'phone **very sensitive,** especially in conjunction with its use with our sensitive Receiving apparatus, the Bakigil Grand, of our own manufacture.

R. I. GILLAND, General Manager.

TESH RADIO COMPANY,
High Point, N. C.

Gentlemen:—We have tried out the **RICO** Tri-pole 'phone which we received from you; **we find it equal in every respect to the highest priced** 'phones we handle. Just as soon as we work off some of our present stock, you may expect a quantity order from us.

TESH RADIO CO., J. Fred. Tesh.

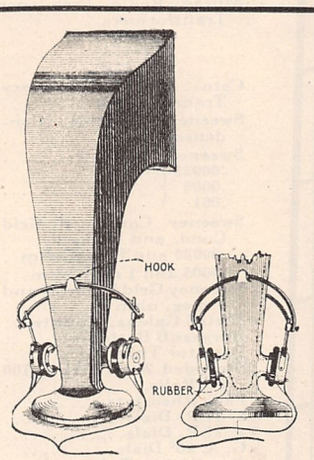


Fig. 1

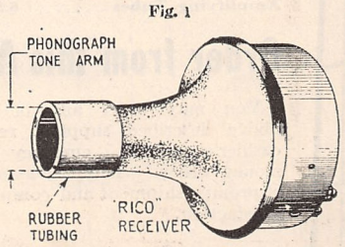


Fig. 2

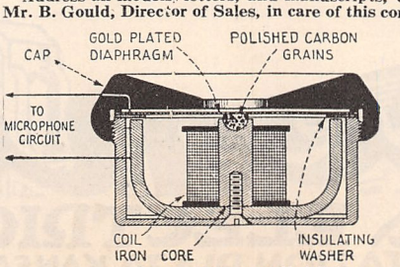


Fig. 3 (Patent applied for)

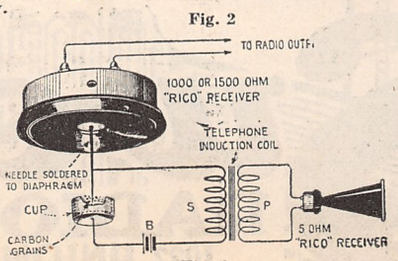


Fig. 4

RADIO INDUSTRIES CORP.
131 DUANE STREET - NEW YORK, N. Y.

Every Radio Enthusiast and Radio Dealer is in Daily Touch with the

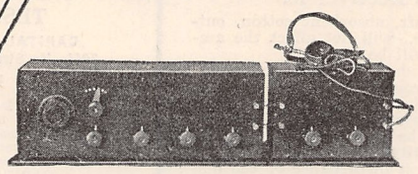
WHB

Great Sweeney Station

This Is One of the Largest Inland Stations in the Country

and sends out official Government market and weather reports every day, besides giving musical, educational and religious programs on Sundays, Tuesdays and Thursdays. Through the courtesy of C. G. Conn & Co., Elkhart, Ind., Makers of Musical Instruments, we are broadcasting some of their concerts.

This station cost $20,000 to erect. CALL IS—WHB—360 meters for concerts and 485 for Government reports. 500 watts W. E. set provides its power. This great broadcasting station is evidence of the capacity of the Sweeney Company to serve you in the purchase of all supplies and equipment.



COMPLETE SETS. Ready for immediate delivery the new **Sweeney Radio-Phone.** 5 Vacuum tubes. Built especially for short wave lengths such as under 600 meter W. V. All complete, antenna wire etc., ready to go. Write for pictures and special low introductory price. A very quiet set, giving fine results.

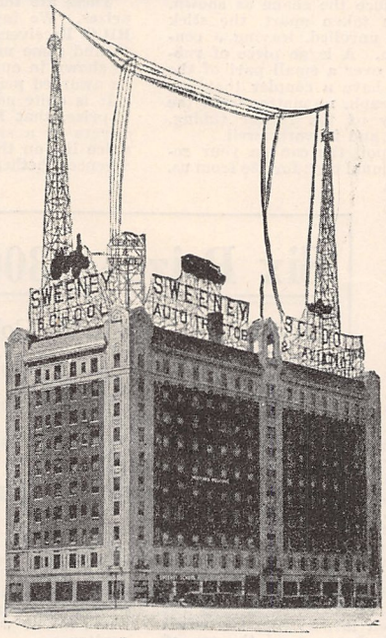
NEWEST AND MOST COMPLETE IN RADIO

You can be sure of getting the best service and lowest prices from Sweeney and the very latest [radio developments. If you want to learn this business, to become a Radio Expert or commercial operator, write for full details of the NIGHT SCHOOL now running.
The most complete equipped and thorough radio school in the world. If you want to [buy] a set or build your own set we can give you immediate delivery.

WE HANDLE A COMPLETE LINE OF EQUIPMENT

All parts for building your own sets, also *complete receiving sets.* Dealers write for information. To give you an idea of the stock we handle we are listing below only a few of the parts necessary for installation. *Write today for complete catalog and instruction book.*

Sweeney Variometers	$5.50
Sweeney Vario Couplers	5.00
Radio Service Radio Frequency Transformers	6.00
Murad Radio Frequency Transformers	
T-11	6.00
T-11A	6.50
T-11B	7.00
Coto Coil Frequency Transformers	5.50
Sweeney Variable Condensers	3.75
Sweeney Condensers .00025 .0005 .001	.35
Sweeney Combined Grid Cond. and Leaks .00025 and 1 meg. ohm	.50
.0005 and 1 meg. ohm	.50
Sweeney Grid Leaks, .5 and 1 meg, ohm	.25
Tested Galena, Mounted	.35
Burgess B Batteries	3.00
Detector Tubes	5.00
Stranded Aerial Wire, 100 Ft. Rolls	1.00
Fada Rheostats	1.00
3" H.R. Dials	1.00
4" H.R. Dials	1.50
G. A. 90° Dials	1.25
Amplifying Tubes	6.50
Federal Phones	$8.00
Brandes	8.00
Wesrad Amplifying Transformers	5.00
Thordarson Amplifying Transformers	4.50
Federal Amplifying Transformers	7.00
Federal Plugs	1.75
Federal Junior Sets	25.00
DeForrest Everyman	25.00
Western Electric Phones	15.00
DeForrest Radio Home	36.00
DeForrest Two Stage Amplifier	35.00
Tube Sockets	1.00
Vacuum Gap Lightning Protector	2.00
Federal Closed Circuit Jacks	1.00
Federal Open Circuit Jacks	.70
Federal Anti Capacity Switch	2.80
Fada Switch	.50
Fada Switch, 8 Contacts, 2 Stops	.75
Fada Crystal Detectors	2.25
DeForrest Crystal Detectors	2.75
G. A. 100° Dials	1.25
Pacent Twin Adapters	1.50
Pacent Plugs	1.25
Pacent Single Circuit Jacks	.70
Pacent Double Circuit Jacks	1.00



Order from this Ad.

You may order any of the above described supplies, remit cashier's check, currency or money order. You are assured of prompt shipment and complete satisfaction.

Catalog and Instruction Book.

Every radio enthusiastic should have a copy of this valuable book which is just off the press. Contains new and interesting matter and descriptions and hints that will save you time and money, including hookups showing connections of crystal, regenerative, and high frequency amplification apparatus and give you much better results. Do not buy any radio supplies until you have seen this book as we have gone into this business on a great scale and are prepared to supply you with the best and most efficient new material at lowest prices. This book has been prepared by some of the best known electrical and radio engineers and practical instructors. Sent on receipt of fifteen cents stamps. Get your copy today.

Sweeney

RADIO & ELECTRICAL CO

1022 UNION STATION PLAZA, KANSAS CITY, MO

RADIO NEWS

H. GERNSBACK—Editor and Publisher
ROBERT E. LACAULT—Associate Editor

Vol. 4 SEPTEMBER, 1922 No. 3

Radio Shows

WHEN radio was young, there was no necessity for a Radio Show or Radio Exposition. With radio becoming popular and taking the public's fancy, a number of individuals have come to the conclusion that one of the most important things in the radio world at present is a Radio Show.

Now the function of a Radio Show or Exposition, the same as that of an Automobile Show or Electrical Show, is definite and well understood. As a rule, it has the sole purpose of bringing the manufacturers and the public closely together. Not only that, but the jobbers and the dealers in the respective businesses have a chance to see the new products of the manufacturers, meet the manufacturers themselves, and look over their new line. A Radio Show has exactly the same function. If properly managed, properly advertised, and held once a year, such an exposition is a wonderful boon for all concerned. Unfortunately for the young radio industry, the radio show business has assumed proportions which deserve the strongest denunciation, and if there are many more radio shows being staged by every individual who takes it into his head to run such a show, the radio industry will soon have a much blacker eye than it had in the old days of the wireless stock jobbing which retarded the art for at least ten years.

We have no quarrel with any one individual who stages a Radio Show, except that we call the public's attention to the fact, that, with the exception of one or two such expositions, *there has not been one that made money* for either the exposition or the exhibitors. In other words, with possibly two exceptions, all the radio shows so far staged have been failures.

The reason is obvious. When, last Winter, the first New York Radio Show was held, every manufacturer of note was represented. A manufacturer who is busy and has his hands full is not inclined to take the time and money to be represented at a dozen radio shows each month. It simply cannot be done.

Imagine the automobile industry being asked to exhibit from six to twelve times a month in cities varying from the largest down to towns of the size of 20,000 inhabitants! The automobile industry would never stand for it, because they know that in the long run it would be a detriment to the industry. The fault, of course, does not lie with the exhibition itself. If there is a yearly exhibition in our large centers—let us say towns with not less than 500,000 inhabitants—then we believe that the radio industry at large will not be averse to contributing space and time, as well as money, to these shows. But if there are dozens and even hundreds of these shows going on all the time, it stands to reason that such exhibitions must be failures. There being but few exhibitors, nothing of interest will be seen at the shows and when this becomes public no one will attend. This has been the case in nearly every instance recently, and it seems surprising that the individuals who are organizing these shows do not see the light but still continue to stage these absurdities, for reasons best known to themselves.

The great and unprecedented number of radio shows, the organizing of which may be termed the "radio show business"—an industry by itself—is no doubt due to promoters. It usually works in this wise:

A few men get together and proceed to rope in some man or men who are known to have money. Then they show him figures of the radio industry, also reprints of publications showing the unqualified success of the first New York Radio Show, where thousands of people were turned away and which show actually made a handsome profit. With such figures it is, as a rule, easy to ensnare some foolish investors who imagine that they can clean up a small fortune from such a show. Of course, the promoters realize full well that this cannot be done, but before the show closes it has been possible for them to pull the wires in such a way that most of the fortune has gone into their own pockets.

If every investor who is asked to finance a radio show were shown this editorial this parasite on the radio industry would soon be exterminated.

We have heard of and seen exhibitions at which scarcely a dozen manufacturers were represented. The public was so adversely impressed by these affairs that radio in these towns, instead of progressing, actually has been retarded for years. The next radio show that is held in such a city or town will fare even worse, due to the poor impression made by the first one.

The Editors believe that there should not be more than one show a year, at the most, in any of our large centers. If there are more, they become mischievous and defeat the very object sought. If, as we suggest, the shows and exhibitions are confined to cities of over 500,000, then we would have radio shows only in the following cities:

New York	Boston
Chicago	Pittsburgh
Philadelphia	Los Angeles
Detroit	Buffalo
St. Louis	San Francisco

We believe no manufacturer would object to this, providing the time element was such that he was not asked to exhibit at the same periods of time in the various cities.

It may be assumed from past experience (and we believe we shall not be seriously contradicted by any of the old manufacturers), that the radio season is between October first and April first. In other words, all the radio exhibitions should be staged during this period. We certainly believe that it would be the best idea for all the manufacturers to get together and vote on such a plan. If there was an agreement between all the principal manufacturers that they would not attend any shows except along the lines outlined above, we believe that it would help the industry tremendously. An exhibition would then be a credit to the entire industry, because every one would be represented and the public would take note.

RADIO NEWS believes its mission is to enhance the radio industry wherever it is possible. For that reason it has taken upon itself to append a coupon at the bottom of this page, and the Editors invite manufacturers to fill out this blank and return it immediately upon receipt of this issue. The full results will, if all the returns are in, be published in the next issue of RADIO NEWS. Any suggestions will be gladly received by the Editors.

H. GERNSBACK.

VOTING BLANK

We, the undersigned, are / are not in favor of the plan outlined above. We suggest the following: .....

.....

.....

There should not be more than.....Radio Shows in the United States during the period of one year.

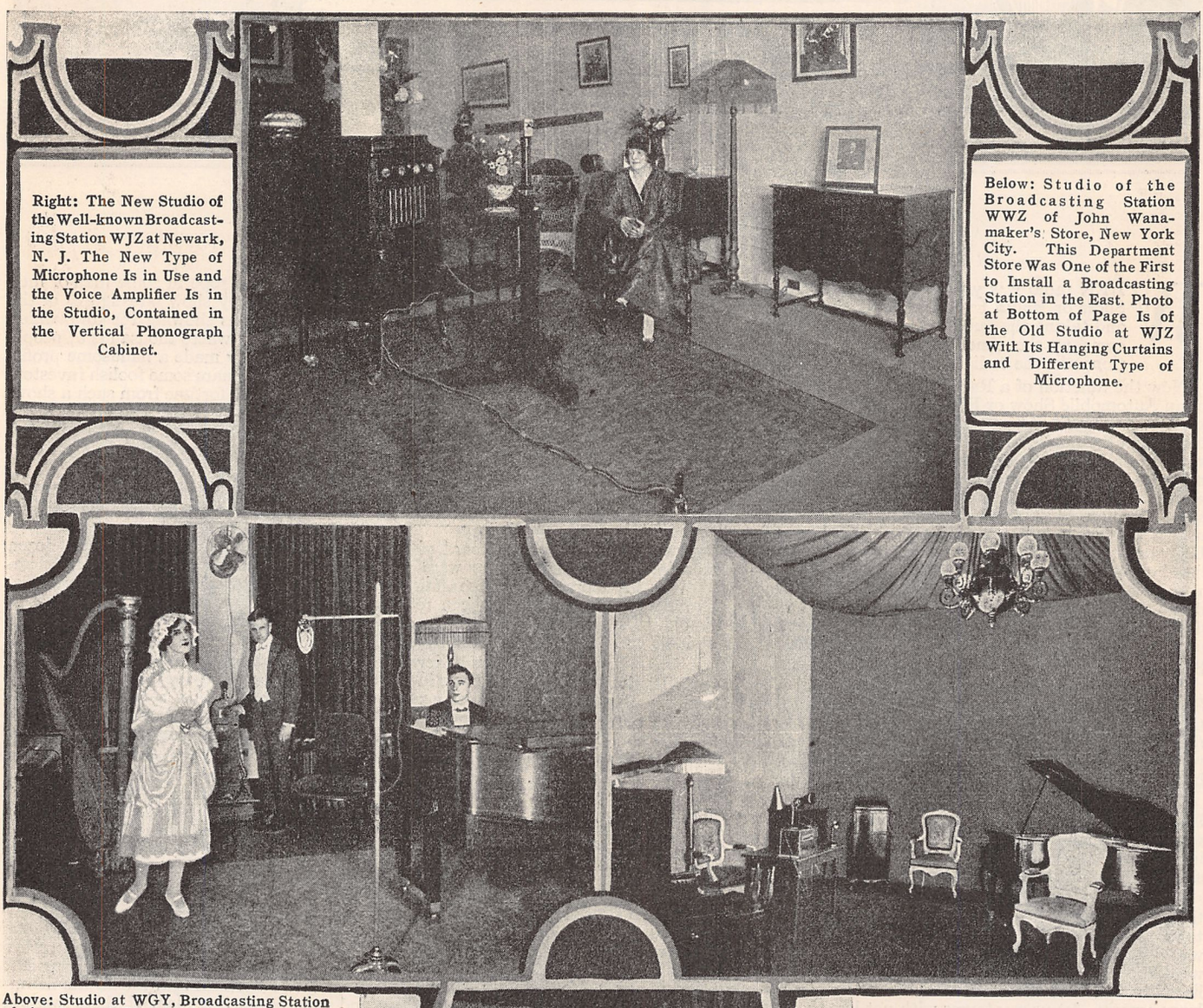
We are / are not in favor of agreeing with other manufacturers on such a plan.

(Signed).....By.....

Broadcasting Methods

Apparatus, Equipment, Studios, Programs and Administration of Big Stations a Radio Art

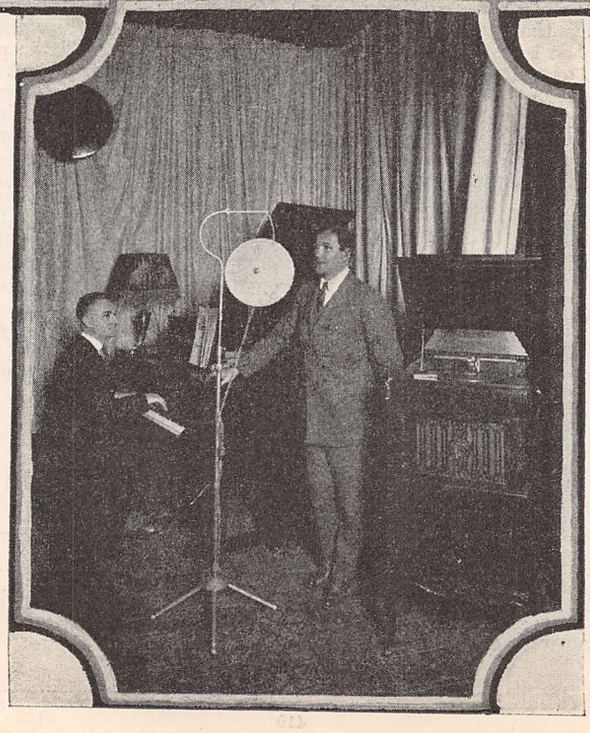
By C. E. LeMASSENA



Right: The New Studio of the Well-known Broadcasting Station WJZ at Newark, N. J. The New Type of Microphone Is in Use and the Voice Amplifier Is in the Studio, Contained in the Vertical Phonograph Cabinet.

Below: Studio of the Broadcasting Station WWZ of John Wanamaker's Store, New York City. This Department Store Was One of the First to Install a Broadcasting Station in the East. Photo at Bottom of Page Is of the Old Studio at WJZ With Its Hanging Curtains and Different Type of Microphone.

Above: Studio at WGY, Broadcasting Station of the General Electric Co. at Schenectady, N. Y. The Controller and Announcer Is Seen in the Background.



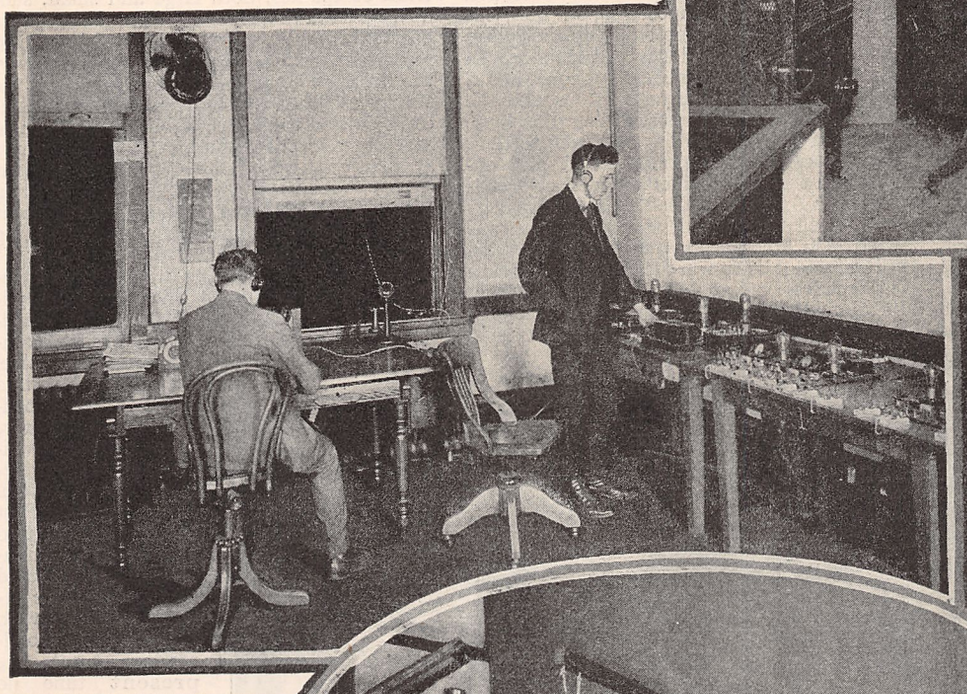
AS soon as the radiophone's adaptability for broadcasting reports, concerts, lectures, religious services, news and other forms of entertainment became recognized, a new field of endeavor was created, known as Radio Art. The beginnings were crude and, therefore, subjected to any and frequent changes in method and in kind. The developments in a single year have been so astonishing as to warrant the assumption that another twelve months will be even more fruitful with respect to improvements and functions. It is estimated that there will be 25,000,000 receiving sets in use at that time, which presages a world enmeshed in radio. The possibilities for the extension of culture, education, knowledge, advertising, entertainment, religion, politics, etc., are limitless, and therefore beyond man's power to prophesy. It is a tremendous, an astounding outlook, with magnificent opportunities if rightly and correctly employed.

There are over 19,000 licensed radio transmitters, 15,495 being amateurs engaged in sending and receiving messages for personal amusement; 2,783 American shipping; 439 commercial; and 348 experimental. Of the 15,495 regular stations, the most important are located in the East: Pittsburgh (KDKA), Newark (WJZ), Chicago (KYW); Springfield, Schenectady (WGY), operated by the General Electric Co., and New York City (WWZ) by John Wanamaker.

While the methods employed by each of these stations are similar in many respects, there are numerous details in which they differ; it will be interesting to compare such methods. There are five distinct stages of broadcasting: (1) object, (2) apparatus and equipment, (3) studio, (4) programs and (5) methods. Under each of these heads may be considered the various phases pertaining to it. For example, "Object" includes selling, revenue, expense, advertising, publicity, market for apparatus and public benefits. "Apparatus and Equipment" comprises technical arrangements, amplifiers, microphones, operators, antennæ, counterpoise, oscillators, modulators, station, wavelength, tuning, generators, motors, etc. Under "Studio" we have management, arrangement, reception,

outfit, accessories (pianos, organs, phonographs), transportation of artists. "Programs" include make-up, hours, booking, personnel, requisites, policy, management (impresario), expense. "Methods" embraces a large accumulation of items, such as vocations, criticism (outside and inside), letters, suggestions, improvements, advertising, publicity, compensation, expense, grouping, experiments, and particularly direction upon which the success of the work depends materially. An able guiding mind and hand is the backbone of radio broadcasting during this present period of florescence.

Right: Operating Room of the Broadcasting Station KYW at Chicago. The Transmitter Is Seen to the Left.



Above: Control Room of the Transmitter at WGY.

Right: Studio at KDKA, Pittsburgh, Pa., the Pioneer Broadcasting Station. The New Microphone and Speech Amplifier Are Shown.

All large broadcasting stations are operated by a staff under the supervision of one responsible person. This radio impresario carries a heavy load upon his shoulders, for the position is such as only one possessed of knowledge, understanding, experience and ability can fill. Upon the kind of service he and his staff devise and upon the way it is handled depend the success of their endeavor. The only financial return from such costly service is of course the sale of receiving apparatus in which other manufacturers and all dealers participate without cost. But without this service there would be fewer sales, therefore it is imperative that it be kept up and in the best manner possible. To install a broadcasting outfit and maintain adequate service runs into big money. Without going into details as to this particular matter, let us turn to the methods employed by the six big stations.

As the pioneer in the art, the Westinghouse Company is entitled to first consideration. KDKA has been in operation since November, 1920, and it is due to the experiments and developments of this station that radio art has advanced so rapidly. Comparing broadcasting of to-day with that of a year ago, the improvement is as remarkable as it is satisfactory. There still are limitations and problems to be overcome, but the listener-in is getting better results every day and radio fans are increasing more rapidly than manufacturers can supply sets. Radio art is a constructive force, so it is the duty of everyone to support it and assist in its progress toward perfection, which ultimately means much to the world at large.

Every broadcasting station, aiming faithfully to transmit radio news or entertainment, must be equipped with high-class apparatus. In the six big stations particular attention has been paid to the installation of material of highest quality, such as is not found in smaller stations. At the beginning it was soon discovered that an equipment giving satisfactory oral results was inadequate for music transmission. Therefore much experimenting and changing had to be done to improve the quality of transmission so that both voice and music could be faithfully reproduced. The scientific problems of broadcasting having reached a stage of comparative satisfaction, attention could be given to methods.

The four plants of the Westinghouse group, growing out of the company's experience in equipping American aeroplanes in France with radiophones, are conducted upon the same principles and embody practically the same ideas. It will not be necessary to describe each, therefore we will select the WJZ station as representative, although it did not begin to broadcast until eleven months after its sister station KDKA at Pittsburgh. The apparatus at Newark is efficient, consisting of a six-wire counterpoise antenna, which provides for multiple tuning on far end. There are eleven wires, 150′ long and 124′ above the roof, which is 100′ above the ground. The natural wave-length is reduced to 360 meters by the use of special condensers in series on the Westinghouse aerial. An ingenious arrangement obliterates inherent distortion of the vacuum tube transmitters so that the speech and music is of unusual clarity, limited only by characteristics of the microphone, which transfers the sound-waves in electrical form to the amplifier.

The station is complete with respect to studio and arrangements. The old broadcasting room has been replaced by one of larger and more adequate dimensions. It is attractively furnished and located on the first floor, convenient to artists and organizations. A grand piano, an organ, a phonograph and other musical instruments form part of the equipment. An interlocking system of switches and light signals connects the studio with the transmitting room on the roof. The microphone used is the cup style suspended from a movable arm attached to a portable stand. The sound-waves are sent through the microphone to an amplifier box in the same room in which they are amplified many times and then transferred to the roof, where they are increased to the required amplification. This is a new method by means of which transmission over a long telephone wire from microphone to main amplifier is eliminated, an obvious advantage.

The daily program is arranged in accord-

(*Continued on page* 498)

Radio Broadcasting In Great Britain

Written Especially for RADIO NEWS

By JOHN SCOTT-TAGGART,* F. Inst. P.

RADIO broadcasting has reached England. Why nothing was done before is rather a mystery, but it is nevertheless true that America has led the way in this new feature of every-day life. The part played by American inventors in the development of radio telegraphy and telephony is a very great one, and American imagination has once more introduced to the world almost a new art.

Radio in England, as far as the radio amateur is concerned, has never been of such widespread interest as in America. Before the war there were a few enthusiasts working on crystal detectors who received messages from ship and shore stations and from some of the bigger continental radio stations, such as the Eiffel Tower. At the end of the war, radio amateurs began to agitate for permission to resume their activities. Things had greatly changed; the thermionic tube had revolutionized the old methods of reception.

The British Post Office, which regulates the granting of licenses to amateurs, at first insisted on special permits being necessary before any radio apparatus could be bought. If an amateur, for example, desired to buy a vacuum tube he had to apply to the British Post Office for permission to do so. Moreover, he had to indicate what circuit he proposed to use. He was limited to an aerial 100′ in length if a single wire, and a total length of 140′ of wire if the aerial was composed of several spaced wires.

At the present time the only restrictions which really remain are the ones which relate to the antenna. There are about 250 amateur radio-transmitting stations which mostly work on a wave-length of 400 meters, and to obtain permission to carry on communication, special regulations are enforced which make it difficult for amateurs to interfere with Government and commercial stations.

This has always been a great fear in official circles in Great Britain. It has, therefore, been extremely difficult for experimenters to receive all the facilities they asked for. Only a few months ago the Wireless Society of London asked permission for one of the radio companies to send out radio telephonic messages. The British Post Office consented to allow calibration waves to be sent once a week on low power from one of the commercial stations. Later they were persuaded to allow a commercial station to send out for fifteen minutes a week a radio telephone concert on a power of only ¼ kilowatt.

The total number of radio amateurs in Great Britain was, until very recently, about 8,000, and this number included a very large number of proficient experimenters. The trans-Atlantic tests resulted in many British amateurs receiving the messages, although insufficient publicity has been given to this in the American journals. It is, nevertheless, a fact that a number of British radio experimenters working under all sorts of unsuitable conditions and with only 100′ aerials were almost as successful as Mr. Godley with his elaborate apparatus working in the best possible position with a very long aerial.

So much for the British amateur. While he was endeavoring to obtain some alleviation of the restrictions imposed upon him, his American confreres were enjoying the fullest liberty. Tales reached England of the wholesale broadcasting of radio-telephone items, such as concerts, lectures, sermons and the like. People from America brought these tales, and English visitors returning to their home country corroborated them and enlarged on the extraordinary success of broadcasting in America. The British newspapers gave reports of this development that was going on in America and questions were asked in Parliament as to whether facilities for similar broadcasting would be granted in Great Britain. British radio companies, recognizing the huge market for radio sets, encouraged the campaign for greater liberties.

Photo by Underwood & Underwood

One of the Many New English Amateur Receiving Stations, Which Have Been Installed in Anticipation of the New Broadcasting Stations. The Family Are Listening to Radiophone Concerts from Holland.

No longer was it a case of radio societies struggling for slight extra concessions, but it was the whole country anxious to take a share in the new possibilities of a broadcasting era. With almost lightning suddenness everyone in the country was demanding to know something about radio broadcasting. The newspapers were full of it, the British Postmaster General himself became an enthusiast and practically all restrictions on radio reception were lifted.

The question immediately arose: Who was to erect these broadcasting stations? A monopoly of such an important public service was rightly considered as impossible and it was also essential that adequate control of the broadcasting stations by the Government was necessary.

There are only two large radio companies in Great Britain, namely, Marconi's Wireless Telegraph Company, Limited, and the Radio Communication Company, Limited. Both these companies were prepared to erect and work radio broadcasting stations and the latter company joined forces with the Metropolitan-Vickers Electrical Company, a concern very closely associated with the American Westinghouse Company.

Not unnaturally, however, all sorts of electrical companies, both large and small, suddenly desired to have a hand in the very large business accruing from the sale of broadcast receivers. The General Electric Company, the British Thomson-Houston Company, the Western Electric Company and other concerns desired to participate in the erection of radio broadcasting stations. About twenty applications altogether were made and it was clearly obvious that for efficient working within a retricted area, such as that of Great Britain, the fewer the number of broadcasting companies the better.

Accordingly a meeting was arranged between the General Post Office and the applicants for permission to set up radio broadcasting stations. The outcome of the conference was that it was considered desirable, if possible, to form a single radio broadcasting company, each of the applicants having representatives therein. The British Post Office in fact, told the various companies that they should arrange between themselves who should do the broadcasting. Up to the present time no agreement has been reached between the different companies, but it seems likely that in the event of the one-company idea falling through, two companies will be formed, one group being headed by the Radio Communication Company and the other by the Marconi Company. As soon as a definite agreement is reached as regards who is to erect the broadcasting stations, these latter are to be built at different centers of Great Britain. So far as present plans go, broadcasting stations of 1½ kilowatt power are to be erected at the following towns: London, Manchester, Birmingham, Cardiff, Plymouth, Newcastle, Glasgow.

It will be seen that instead of having one or two large power transmitting stations it is proposed to have about seven small power stations all working on slightly different wave-lengths. The general idea in doing this is to prevent broadcasting reception being dearer in one part of the country than in another. For example, if there were one big station, towns in the neighborhood of it would be able to pick up the messages on a crystal receiver, whereas the public living in towns several hundred miles away would probably require receivers using several vacuum tubes.

PROGRAM FOR BROADCASTING STATIONS

The program it is proposed to put into force will be similar to the American ones.

(*Continued on page 537*)

**Author of "Elementary Text-book on Wireless Vacuum Tubes" and "Thermionic Tubes in Radio Telegraphy and Telephony".*

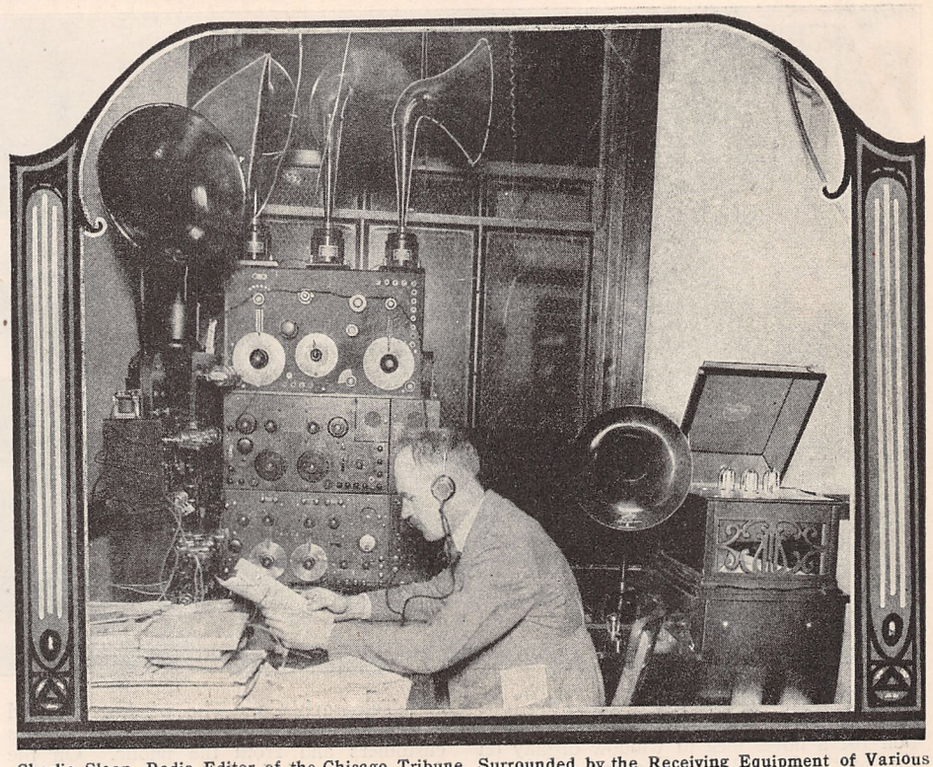
Newspapers and Radio

WESTERN newspapers have given radio its greatest impetus and in the educational work carried on in the columns of the daily and weekly papers the public has found in radio an absorbing topic from day to day since the wave of wireless enthusiasm first swept the country.

However, there is some diversification of this educational publicity. Some publishers have advanced farther along the road of practical experiment. While some have set themselves to the task of broadcasting news, harmonizing with and working through the local broadcasting stations, others have given over permanently spaces for long technical treatises by radio experts.

The Chicago *Tribune* has "gone them all one better," so to speak. It has taken the lead by spending thousands of dollars for an up-to-date radio plant, with equipment of the newest type and a wave-length range of 10,000 meters. While no broadcasting is done, the *Tribune* plant and its antenna stand forth, boldly symbolizing that newspaper's slogan, "The World's Greatest Newspaper," with a parallel exemplification of its editorial policy so far as Armies and Navies are concerned—uncompromising preparedness. In Radio, too, they believe in preparedness. The *Tribune* believes in a thoroughly organized radio and aircraft service, and they are ready to "tell the world" they will take no back seat in radio preparedness.

Charlie Sloan, the *Tribune's* radio editor, gives the public every day the most concise summary of what is happening in the world of radio, the *Herald Examiner* running a close second with its intense campaign for local development among the "fans" and the *Daily News* issues a "Radio Supplement" every Saturday.



Charlie Sloan, Radio Editor of the Chicago Tribune, Surrounded by the Receiving Equipment of Various Types Installed in This Newspaper Office.

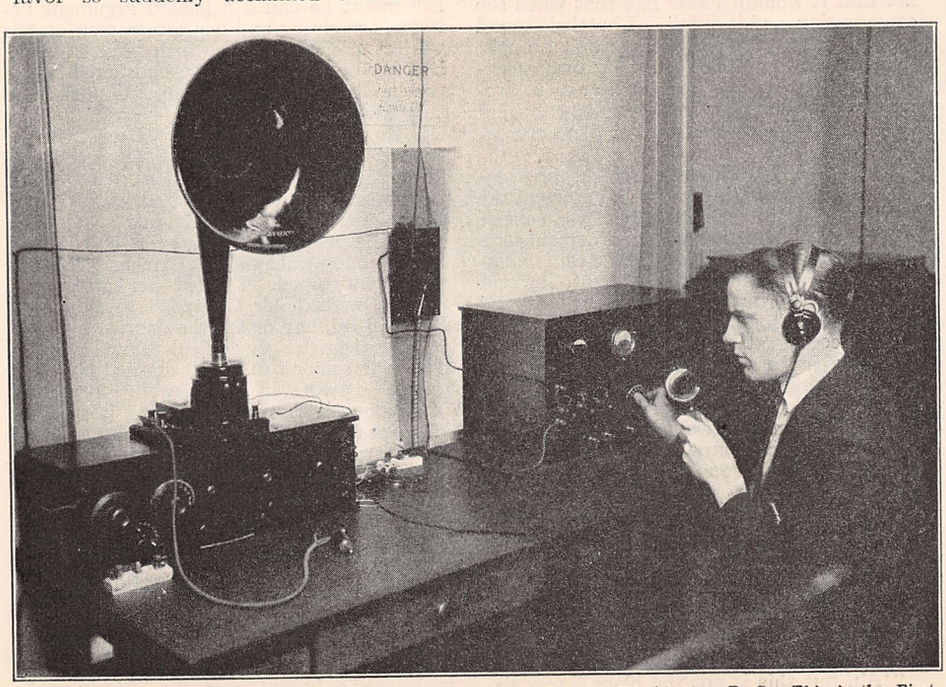
Some of the *Tribune* equipment now hooked up is an Aeriola Grand mahogany, Westinghouse outfit, Colin Kennedy, two-stage amplifier, two Western Electric 7 A. amplifiers, Heterodyne radio receiver, type R.B., with a registered wave-length capacity of 5,200 meters; a Radio Receiver of the long wave type made for the Navy Department, with a range from 1,000 to 10,000 meters; audio fre-

(*Continued on page* 536)

Radio Broadcasting and the Department Store

By S. R. WINTERS

THE department store—the place of assembly for men, women and children, representing all walks of life—early recognized the advantages of installing radio-telephone receiving equipment when popular favor so suddenly acclaimed this instrumentality as a means of universal communication. Ordinarily, however, the departmental mercantile establishment confined its activities in this direction to the installation of units for the reception of concerts and conversation circulating through ether and in the demonstration of radio appliances.



Broadcasting Station WEAS Lately Installed in a Department Store at Washington, D. C. This is the First Department Store in the National Capital to Install a Station.

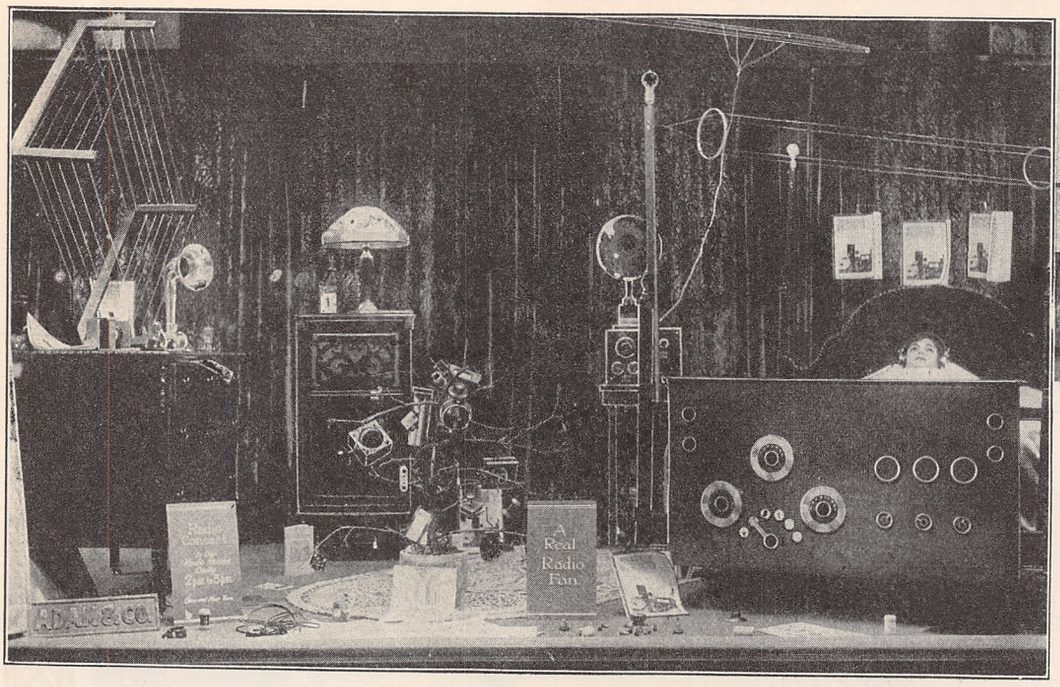
Broadcasting stations, as adjuncts of the mercantile trade, have for the most part been sponsored by stores dealing in electrical supplies. The department stores in large cities are now recognizing the value of the broadcasting program as a popular vehicle for serving the communities in which they are located and as an indirect, though effective medium, for advertising their stocks in trade. The name of a particular departmental mercantile establishment when coupled with a periodical broadcasting program, admitting that the service possesses merit, is bound to redound to the benefits of the commercial concern that has a varied assortment of articles on the market.

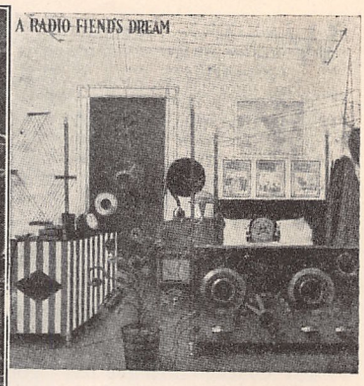
Only recently—June 7, 1922, to be exact—the Hecht Company earned the distinction of being the first department store in the National Capital to install a radio-transmitting outfit and inaugurate a regular broadcasting service. The call letters "WEAS"—the first in Washington, D. C., to have a four-letter grouping—have been assigned to this station. It will operate on a wave-length of 360 meters. The demonstrated range of this transmitting unit is 100 miles, a distance that may be easily exceeded when atmospheric disturbances or other adverse circumstances do not mar its efforts. A tidy and capacious room on the fourth floor of this department store has been handsomely equipped for the purpose of periodically contributing to the diversity of offerings and burdens of the ether around Washington.

The manager of the radio department for

(*Continued on page* 536)

"A Radio Fiend's Dream"





Above is a Reproduction of the RADIO NEWS Cover Which Suggested the Window Display Shown to the Left. The Receiving Sets are All Connected to the Aerials, Including the Bed-Spring. This is the Kind of Window Display that Brings Business.

Photo by courtesy of J. N. Adam & Co.

THE illustration on the cover of the June issue of RADIO NEWS was the inspiration for a novel idea in window display on the part of a Buffalo department store. The occasion was Radio Week in Buffalo, celebrating the opening of the new high-power station of the Federal Telephone and Telegraph Co. The window received a great deal of comment from the store's customers and from the public. On the four corners of the bed, the vacuum tubes were represented by colored lights which flashed alternately.

The different receiving apparatus were connected to the various antennæ, including the bed spring. The tree in the center is a new species and we are rather ambitious to possess one. The window trimmer claims that this particular specimen grew three variometers, one pair of phones and a lightning arrester overnight.

Announcer A. C. N. Tells Some Interesting Anecdotes

By GOLDA M. GOLDMAN

ANNOUNCER A. C. N. of the Westinghouse Station, WJZ, known in real life as Mr. Thomas Cowan, leaned back in an entirely unromantic office chair and "reminisced" to please me.

"Tell me some of the interesting experiences you've had since you started to give entertainments over the radio," I begged.

"Well," said Mr. Cowan, "this place has seen some very interesting men and women since the work started last October. Of course there are the famous artists, like May Peterson, Marie Rappold and Percy Grainger, who have given the listeners-in some wonderful evenings of pure art. And the lighter performances, such as that given by the Pennsylvania Grill Orchestra, have brought over people of the finest type in that particular line of work."

He fingered the flower in his buttonhole and thought for a minute.

"I'm particularly proud of some of the serious messages that have been sent out to the people. They so strongly forecast the things we may expect radio to do in the future. There are the words of Joseph Tumulty, for instance. Do you remember? 'Some people grow; others just swell!' Good idea, that. And Dr. Adolph Lorenz was especially splendid when he talked. I recall the conclusion of his speech. He had been making a plea for healthy children because, he ended, 'Good babies were the saving of the world, much the same as that other Infant, the Infant Jesus, who redeemed the world'."

Mr. Cowan looked serious for a bit, and then broke into the chuckle which makes him look so very young and boyish.

"Of course," he said, "the experiences with the noted artists are the most entertaining. Have you heard about the night that Mme. Margaret Namara of the Chicago Grand Opera Company came over? She had been a tremendous success in 'Thais' at the Manhattan Opera House in New York, on Monday night, and offered to come and broadcast it over the radio on Thursday night. She came here first to look the studio over, as she wanted to have her movie man film her as she sang. When she saw our plain, whitewashed walls, she was thoroughly disgusted and showed it with the true abandon of the artist. How could anyone ever expect to get atmosphere in that place? I swore to her that it wouldn't look like that when she came to sing, and it didn't. I hustled around for the intervening three days and brought hangings and paintings from my own apartment, ordered palms and cut flowers in profusion, and put a big rose floor lamp behind the piano. You would never have recognized the place.

"It was interesting," went on the originator of the Newark concerts, laughing at the recollection, "to see how superbly an artist can brush all the sacredness of a manager's importance to the winds. When Mme. Namara arrived on the appointed night, she and her maid swept imperially into the manager's office, which they at once converted into the usually contested star's 'dressing-room No. 1.' You can be sure none of us contested it! When the door opened a little later, we had a demonstration of the wonderful power of transformation. No wonder operas are written and music composed because of the beauty of some famous woman.

"On the threshold of the office stood 'Thais', the fair Alexandrian, the inspiration of Massenet's opera. Sandaled and ablaze with jewels she recalled the popular song, 'Rings on her fingers and bells on her toes!'

"While the office force staggered under the impact of this night of thrills, 'Thais' entered the despised studio to be flashed by the cameraman; inside the door she stopped amazed.

"'Ah, but this is not the place I saw the other night,' she declared.

"When I explained that I was the master interior decorator, with all her usual artistic abandon she flung her arms around me and kissed me, telling me what a fine little fellow I was. It took me five minutes to get the powder off so that I could take my place before the camera!

"Then the prima donna sang the 'Mirror Song,' and was photographed in action. The sequel was a stirring duet, which in plain English might be called a heated argument between the singer and her cameraman on the subject of close-ups, on which Mme. Namara had her own views, as she had acted before the camera on other occasions. As usual the lady won!

"Then the scenery was 'struck' in the studio, while Madame struck the scenery of 'Thais' and got back into civies.

"The curtain showed me tucking a fur robe around her in her car. It was a cold raw evening, and after seeing the costume of 'Thais,' one would want to be sure she was warmly wrapped. I filled her arms with flowers, wished her Godspeed to Bayshore, Long Island, and closed the door.

"But the manager's office! Powder! Powder on the floor so thick it showed her footprints! Powder in the inkwell! The force of announcers turned themselves into mops, and, regardless of dignity, we cleaned that place up so that the boss wouldn't see it in the morning and call us down."

Mr. Cowan ran his fingers through his curly hair and leaned back in evident enjoyment.

"Want any more?" he asked hopefully. "Well, here's a story of another kind. Lydia Lipkowska, the Russian coloratura soprano of the Imperial Opera of Petrograd, sang for us on the night of January 4th. We knew it was a great treat for every one listening-in, but the really wonderful part of the evening we learned only quite recently. Many weeks

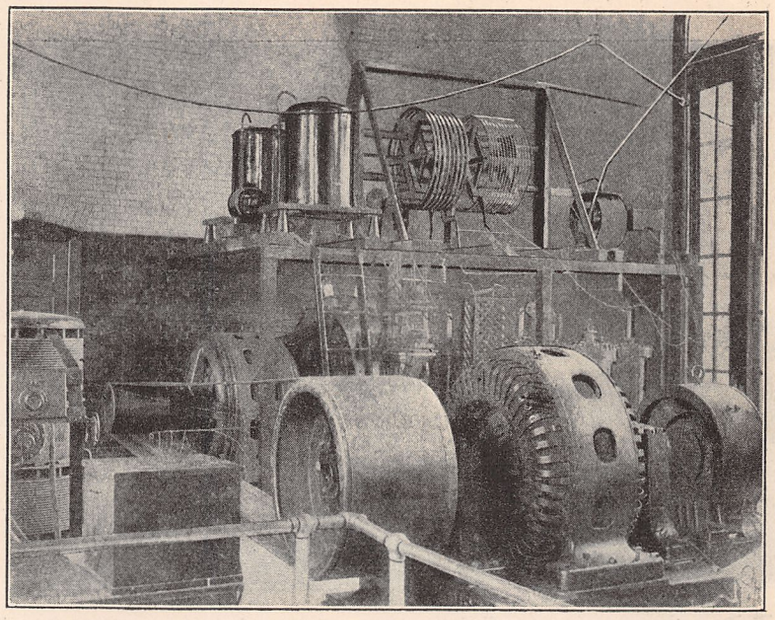
(*Continued on page* 533)

Most Serviceable Government Radio Station in the World

By S. R. WINTERS

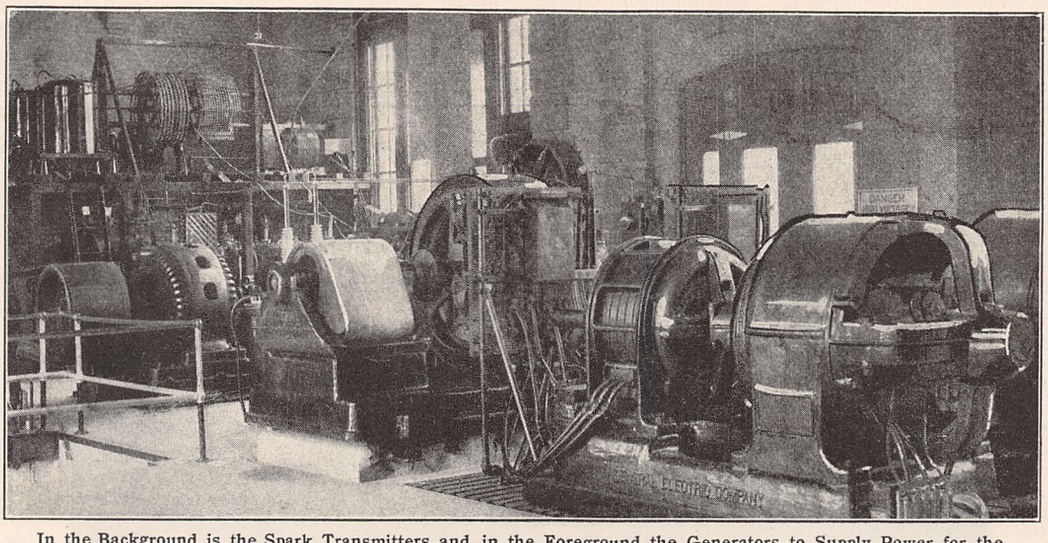
THE inauguration (on June 15, 1922) of a service for broadcasting market reports and other agricultural information from the radiotelegraph station of the United States Navy Department at Arlington, Va., justifies the use of the superlative contained in the title of this article. "NAA"—call letters for Arlington, or Radio, Va., the latter being the post-office address—in thus expanding its program of performance lends additional variety to its already twenty-four-hour day service as a public utility. The diversity of its interests and its popular identity among the wireless fraternity give to this pioneer high-power radiotelegraph station a prestige unexcelled.

Time and weather signals alone, long disseminated by this quick-action public servant, would serve to identify the Government wireless unit at Arlington as a popularizing force in the interest of the new science of radio broadcasting. Both at noon and at ten o'clock P. M., daily time signals from the United States Naval Observatory are flashed to near and remote points. Broadcasting programs, published in newspapers, almost invariably are introduced with the offerings of "NAA"—Naval Radio Station, Radio, Va.—as follows: 10.30 A. M., meteorological report on 5,950 meters of arc transmitter; noon and 10 P. M., time signal, followed by weather report and ship orders; 10.30 P. M., naval press news, wave-length 2,650 meters. Time and weather reports may be received on the "wing" for a radius of 1,500 miles of Washington, while through the service of relay points this knowledge well-nigh covers the United States as if it were a blanket.



View of the spark transmitting apparatus by which time signals, press and weather reports are sent out from NAA.

The newly introduced feature of giving wide dissemination to market reports and allied information from the United States Department of Agriculture is utilizing continuous-wave radiotelegraph transmission, employing a wave-length of 5,950 meters. A brief report of the hog markets will be dispatched at 9.15 A. M. Knowledge of fruits and vegetable shipments and prices are released at 10 A. M. This information is followed, after an interval of forty minutes, by reports of dairy activities originating in Chicago and New York. From 11 A. M. to 1.05 P. M. complete live-stock reports of the Chicago, Kansas City, St. Louis, St. Paul and Omaha markets are broadcasted. The conditions of the grain, fruit and vegetable markets are dispatched in the afternoon. Hay, feed, dairy and poultry markets, as to their fluctuating conditions, are also recognized in this nation-wide agricultural service by radiotelegraphy and radiotelephony. Likewise arrangements are being perfected for dispatching crop information from "NAA."



In the Background is the Spark Transmitters and in the Foreground the Generators to Supply Power for the Arc Transmitter with which NAA Handles Traffic

As overshadowing as the public service of the radiotelegraph station at Arlington may appear, its transaction of Government and inter-departmental business is quite as comprehensive. Little is it known that the Signal Corps of the United States Army draws upon the resources of this versatile transmitting unit for the negotiation of its affairs. A tube transmitting set is employed by the latter for handling its wireless traffic. The unit is of remote control and can be conducted from the Signal Corps headquarters in the Munitions Building, four miles away. Similarly the Navy Department, through the convenience of remote control, can negotiate its business from headquarters in the Bureau of Engineering, under the direction of Commander Stanford C. Hooper. A tube set at Arlington is available for aircraft communication. Also a 5-kilowatt set for local traffic is accessible, but is rarely pressed into service.

The Navy Department, however, in sharing the facilities of its radiotelegraph station with other government departments and the public, is not neglectful of its own peculiar needs. The 100-kilowatt arc transmitting set is employed for the transaction of naval business with such remote wireless stations as Key West, New Orleans, Boston and San Juan. The tube transmitter is jointly shared by the Navy Department and Signal Corps of the United States Army in maintaining

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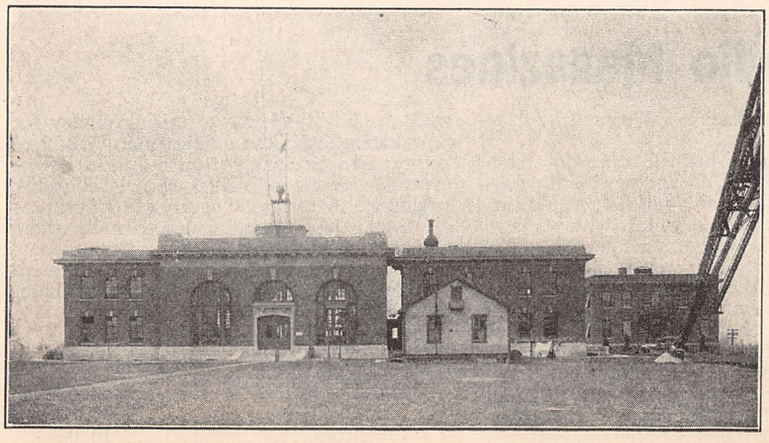
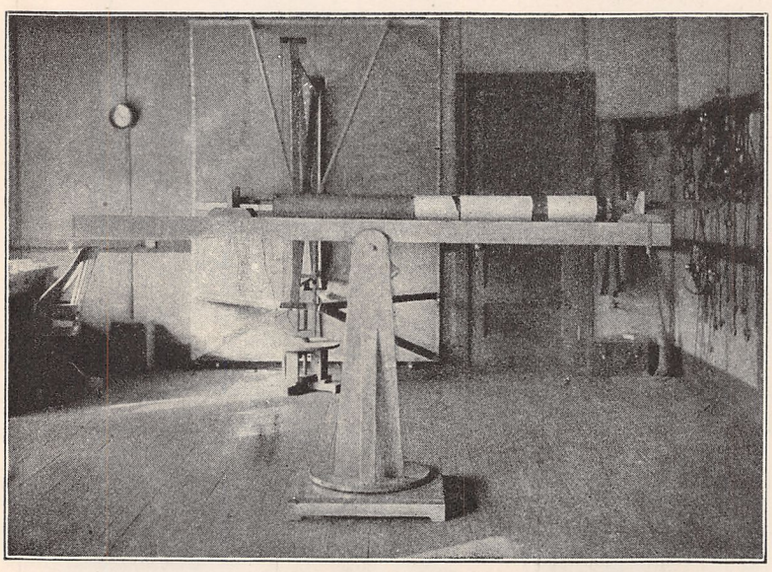


Exterior view of the operating rooms at NAA with a leg of one of the towers visible on the right

Static Eliminator

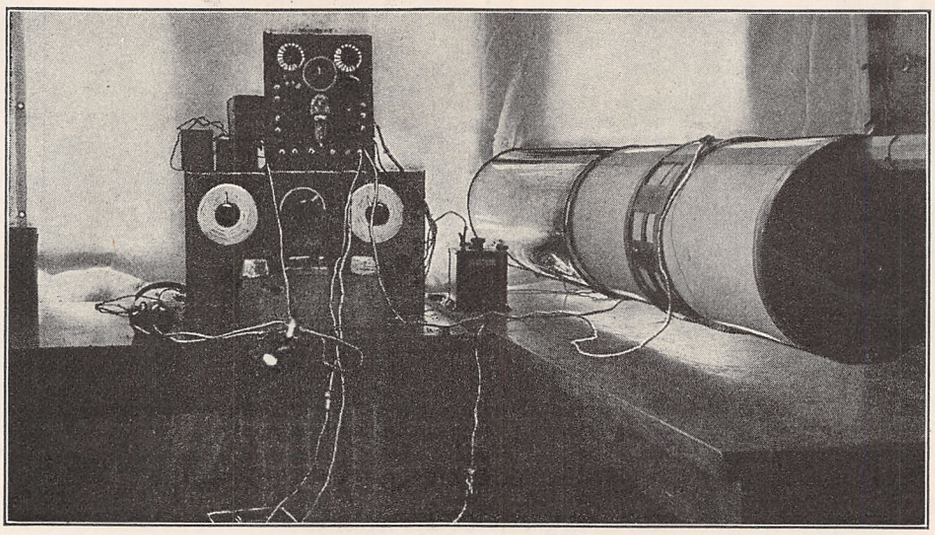
By S. R. WINTERS



One of the new resonance wave coils with which it is possible to eliminate static. The base on which the coil is mounted can be raised or lowered and the stand revolved.

BY the use of a so-called "resonance wave coil," essentially a complete and compact wireless antenna, the Signal Corps of the United States Army claims to have developed a method whereby static electricity or atmospheric disturbances as an accompaniment of orderly radio communications may be eliminated. It is merely repeating a statement of universal acceptance to say that static electricity or atmospheric disturbances is the big retarding factor in the development of radio-telephony. This discordant element in the reception of wireless signals is operative from June to October, inclusive, or about five of the twelve months in the year.

The device of the Signal Corps for instituting proceedings effecting the separation of orderly wireless signals and the crackling, meaningless noises, takes the form of a drain coil of wire. The incoming signals, for instance from broadcasting stations, traverse the so-termed "resonance wave coil," and then proceed to the conventional radiotelephone receiving outfit, regardless of whether the design is a vacuum tube or crystal set. The noteworthy thing, however, is that this coil of wire, or compact antenna, is of a discriminating caliber and only the wireless signals are admitted passage into the radiotelephone receiver. The atmospheric disturbances or static electricity, discordant note that it is, are sidetracked and conveyed to the ground. Such are the claims made for this new form of "static eliminator".



Close-up of the Resonance Wave Coil Which Drains Out Static and Permits Reception Free From Disturbing Noises.

The length of the "drain coil" varies with the distance traversed by the communications that are to be received. The incoming wireless signals are not robbed of their strength or "robustness" by the draining process, according to claims. Moreover, facilities are accessible for amplifying the messages. "Eliminating static noises has been one of the most serious problems in radio development," says Dr. Louis Cohen, consulting engineer of the Signal Corps of the United States Army. "Due to the electrical charges in the atmosphere, especially in summer, even the largest stations must shut down at times. This is a new and radical departure in receiving radio signals. The method consists in receiving the radio signal, passing it through a very long coil, which drains off the interfering disturbances and leaves the full strength signal without noises."

The application of the principles of the "resonance wave coil" in the development of a method for the elimination of static electricity invites brief explicative text concerning this compact antenna. This coil is not only a complete wireless antenna, but its use obviates the need of a receiving apparatus other than a detector and a pair of telephones. It has been fittingly described as "a vest-pocket edition of wireless equipment," and is adaptable to service in the absence of "ground" connection, either actual or counterpoise. As a transmitter the device tunes its own waves and is a single-unit direction finder.

The experimental units of the "resonance wave coil," built by the Signal Corps, are of a hollow cardboard design, 38" long and 2¾" in diameter, around which is threaded a single layer of No. 32 gauge insulated wire. This affords 100 convolutions to the inch. Terminal binding posts are placed at each end of this tube or coil. A brass band or ring, a fixture of the compact antenna, is supplied with the binding post. This ring in its formation is interrupted by a split, one-fourth of an inch wide at a point opposite to the

(*Continued on page* 534)

About Radio Magazines

ONCE upon a time RADIO NEWS and one or two other radio publications were the only ones in the field. Since January 1st we believe that there were added over forty new ones—good, bad and indifferent.

Naturally the more radio publications there are the better we like it, for the simple reason that every such publication, *if it is worthy,* will bring so many more radio enthusiasts into the field and thereby help the art in general. That is what we are after.

There are many ways of starting a radio publication, but we know of only one good way, and that is by having at least $50,000 cash to spare. The publisher who has not this amount or equivalent resources will have pretty hard swimming. We speak from experience!

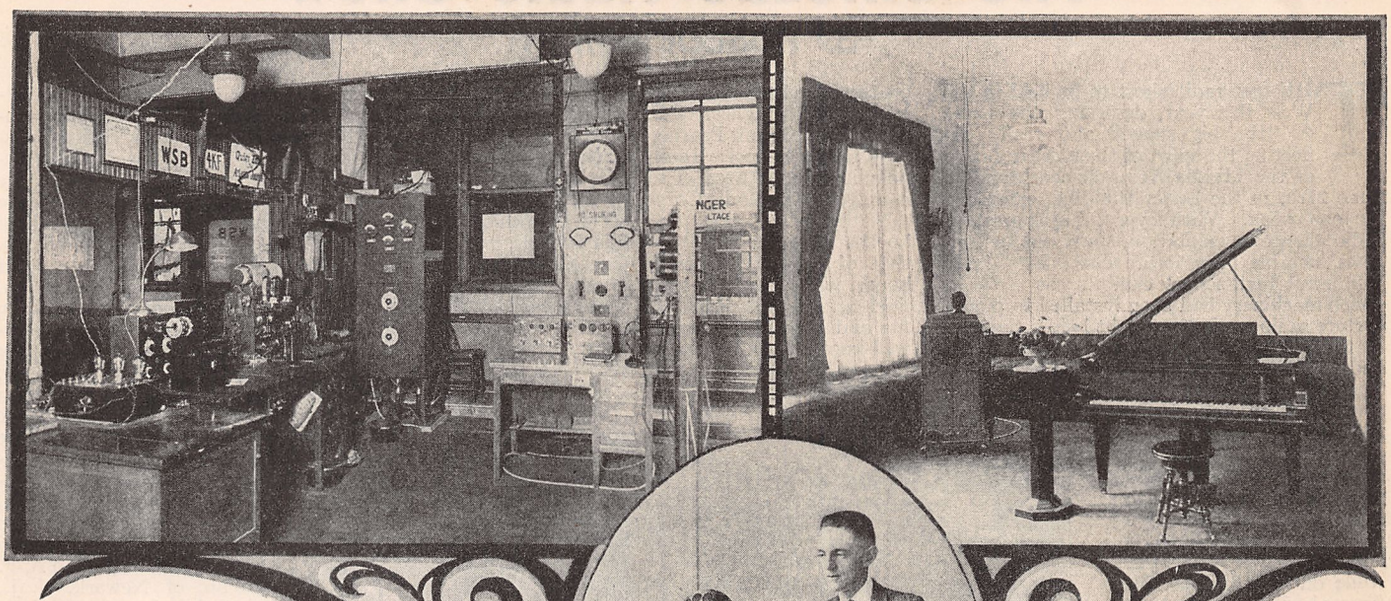
A very wise publisher the other day mentioned to us that of all the new radio publications in the field now, not half would survive until next January 1st. We believe that the guess is a conservative one. The reason of course is that most of the new publishers have not the right backing, or otherwise do not know the business. We have said before that the more radio publications there are in the field the better we like it, and we mean it. The thing we do not like, however, is when radio magazines are financed on the other fellow's money, or when they are connected with stock jobbing propositions.

The present poetical outburst has to do with the latest scheme of raising money for a problematical radio publication. We have before us a circular gotten out by a downtown New York individual who, without any standing either in radio or any other business, gets out a high sounding letter-head, where he urges everyone in the trade to become a member of a Radio Institution to be formed. The dues are trifling and we copy them herewith from the circular.

Honorary presidents	No fee
Radio engineers	$25.00
Broadcasters	20.00
Manufacturers	20.00
Inventors	10.00

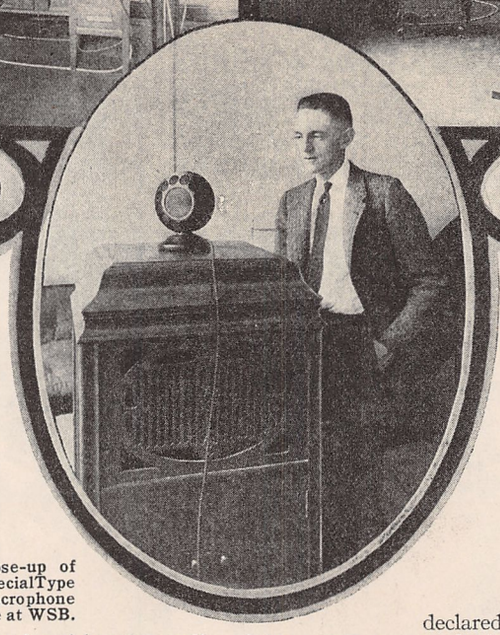
(*Continued on page* 534)

A Southern Broadcasting Station W. S. B.



The New Transmitter at WSB, the Broadcasting Station of the Atlanta "Journal." The Station is Now Completely Installed with One of the Most Powerful Transmitters in the Country.

The Studio at WSB from Which Speech and Music is Broadcasted. Note the Microphone on Top of the Phonograph.



A Close-up of the Special Type of Microphone in Use at WSB.

THE *Atlanta Journal*, one of the leading newspapers of the South, was the first southern newspaper to recognize the significance of radio in the development of modern methods of communication by installing a powerful broadcasting station for the purpose of transmitting news, market reports, weather forecasts and concerts at regular intervals to its readers and friends throughout the South.

Early last March, operating under the call letters "WSB," the *Journal's* radio station inaugurated its broadcastings, using equipment installed temporarily until a more powerful outfit could be obtained. Immediately thousands of persons in Georgia and adjacent states were fired with a wild enthusiasm for radio. A mad scramble to obtain radio-receiving sets and tune in with WSB ensued. To-day practically every home in Georgia is equipped with radio. Each evening when WSB transmits its special program of vocal and instrumental music, literally thousands of radio fans, forming a vast "invisible audience" scattered throughout Dixie, adjust their phone receivers and settle themselves comfortably for an hour's entertainment.

Recently the temporary equipment at WSB was replaced with the latest model of Western Electric radiophone, standard type No. 101-A, using four 250-watt power tubes. This outfit is similar to that employed by the Detroit *News*, the Kansas City *Star*, and at other important broadcasting centers.

Since the installation of the more powerful equipment, hundreds of letters from enthusiastic radio amateurs and novices throughout the South and Middle-West, congratulating the *Journal* on the efficiency of its radio station and praising the quality of the programs, have swelled the daily batch of mail received by the radio department to an incredible bulk.

The *Journal's* vastly increased radio activities now cover a territory extending from Florida to Michigan, and west to Texas. From Miami, Fla., Dallas, Tex., and Detroit, Mich., have come reports of the reception of broadcastings from WSB. Radio fans in Arkansas, Missouri, Texas, Mississippi, Kentucky, Tennessee, Ohio, District of Columbia, Louisiana, Alabama and the Carolinas write that they listen in constantly and enjoy entertainments transmitted by WSB.

When the new equipment at WSB was formally dedicated on the evening of Tuesday, June 13th, a special program, lasting two hours, in which nineteen artists participated, was sent through the ether to listening thousands. This was one of the most elaborate programs ever broadcasted by radio.

At noon and again at 2.30 o'clock WSB transmitted stock and market reports and the weather forecast; at five o'clock news bulletins, baseball returns, daily bedtime stories and recorded music are sent out on the ether waves. The principal program of the day is given at seven o'clock, consisting of musical selections by talented artists of recognized ability. The concerts are sent out from the handsomely appointed, sound-proof radio studio on the fifth floor of the *Journal* building. Here significant radio history is recorded almost daily. Opera singers of international fame have sung at WSB. Henry Ford declared he was inspired with the idea of equipping trains over his railroad with radio while inspecting the *Journal's* radio station.

A unique feature of activities at WSB is a class in radio construction held each Saturday morning in the *Journal's* commodious radio studio. Here hundreds of radio novices, ranging from the ten-year-old thrilled by the mystery of wireless communication, to the elderly business man—just as keenly interested as the youngest lad present—are instructed in the fundamentals of radio. While the radio engineer who conducts the class builds an inexpensive radio receiver, these novices assiduously copy diagrams and make notes with a view to building similar sets for themselves. When the class adjourns, the receiving set built for demonstration purposes is presented to one of the youngsters present. In this way the *Journal* has helped to stimulate interest in radio among the youths of Atlanta, who will be the radio amateurs and commercial operators of tomorrow. Station WSB is believed to be the only broadcasting center in the country performing this novel service for its clientele.

Prescriptions By Wireless

BY HERBERT WARREN DODGE

FIRST the throbbing SOS call penetrated the ether as some stricken vessel, the victim of the winter's wrath, pleaded for aid. Next the timely transmission of Government weather reports assisted ships at sea by informing them of impending storms. Then the Radio Compass was invented to guide boats in dense fogs or storms. Now, finally, PRESCRIPTIONS BY WIRELESS!

Transmitting doctors' prescriptions by radio marks another wireless milestone, and this utilization will mean more in the matter of saving lives than many other applications of wireless telegraphy or telephony.

Because of the fact that less than 25 per cent. of the ships sailing the Seven Seas carried physicians, something to alleviate the situation had to be done. To offset the number of doctorless boats, there are many ships that carry wireless, 80 per cent. to be exact, and with so many vessels equipped with the means of rapid communication, it remained for the Seamen's Church Institute of New York City to adopt wireless as a means of forwarding surgical and medical advice from hospitals on shore to ships at sea without medical services.

In a very short time the Institute had

(*Continued on page* 492)

The Chicago Radio Show

By ROSCOE SMITH

THE first radio show to be held in the West this year, deserving the name of "the big show," and really reflecting the spirit of the radio industry of the Middle West, opened Monday, June 27th, in the Leiter Building, extending for one week. With everything known to radio science on exhibition, many unique concerts, notable open forum discussions, truly wonderful high-school exhibits, at some of which machinery had been installed to manufacture radio equipment right before the eyes of the public and to print radio books, it became readily manifest that the exposition was not only worth while visiting from the standpoint of the layman, the novice and the trained technician, but also highly educational for the public as a whole.

At closing time of the first day more than 11,000 paid admissions were registered, while on the third day these figures had climbed to 20,000, according to the Advisory Board, giving the show every indication of a successful enterprise from the practical standpoint of attendance. Besides this, hundreds of school children gained admission with free tickets.

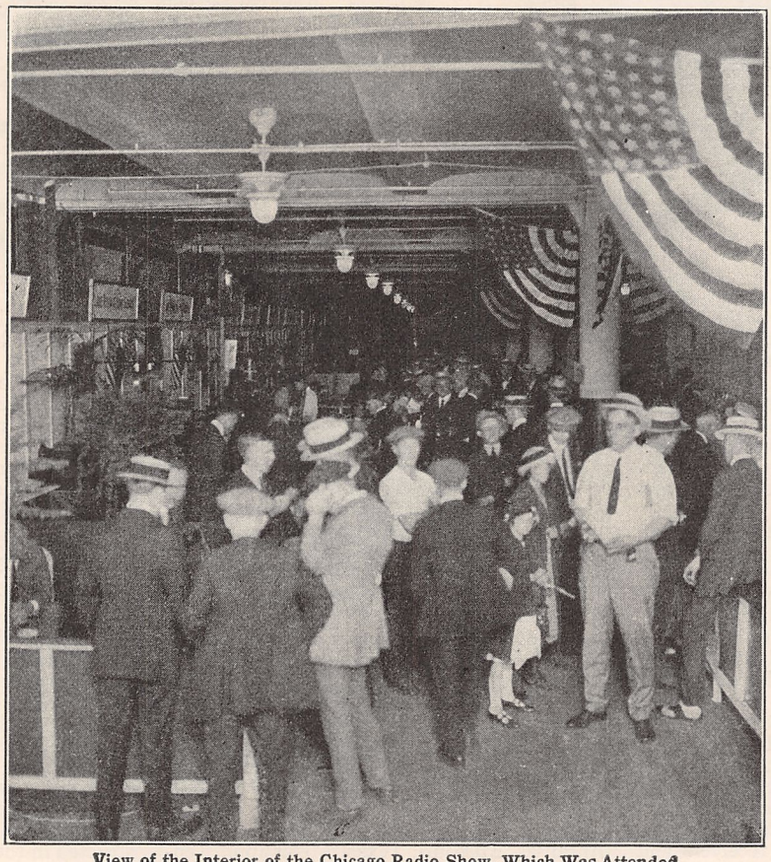
Primitive machines which were considered marvelous when wireless first was demonstrated; memories of the immortal Binns and the ill-fated "Republic"; match box and finger-ring receivers; Radio Cabinets of the Chippendale, Sheraton and Queen Anne style; Aeriola Grands; "Super-Antenna" and abbreviated antenna all visualized the truly remarkable progress of the radio industry in a few years.

All of the Chicago high schools which have contributed in any marked degree to radio progress had booths. Much has been done by these boys who are popularly known as amateurs, but who in many instances deserve the appellation of professionals. Under the guidance of F. H. Pearne and Miss Elizabeth Bergner, two Lane Technical instructors, the Lane contingent set things humming from the very first day. Their wood-turning machinery soon reduced blocks of ordinary wood into variometer parts and Jack Callanan, the Lane student radio exemplar who can answer questions from all comers without running to the technical glossary, was constantly in attendance at the Lane booth. Crane Tech had its exhibits and Tilden and Washburne were also there with their enthusiasts. Contests were held for making the best radio novelty, the best loud speaker of the maker's own design, the smallest efficient set for receiving code, the best regenerative detector and amplifier set, using audio frequency and having a wave length range of from 175 to 600 meters, the best crystal detector set having a wave-length range of from 175 to 600 meters—all of these contests carrying prize awards ranging from $15 to $100.

Lane Tech won the silver loving cup presented for the best school exhibit. Crane Tech was awarded second place. Robert Kelleher received the silver medal for Crane.

Other contests were for speed, code reception, female speed contest and "jamming" code reception. The committee having these contests in charge was J. C. Hail, chairman; Prof. R. E. Hughes, of the Evanston High School; and Frank Pearne, of the Lane Technical High School; Radio Inspector L. R. Schmidt and Alfred Thomas, Jr., district manager of the Radio Corporation of America.

Without question the most imposing booths were those of the High Schools and that of Lyon and Healy, Chicago musical house, which seems to have entered the radio field on a large scale. They offer radio outfits and accessories manufactured by all the well-known producers, maintain a service bureau, install outfits and erect aerials and appear to have injected the same spirit of organization into the radio business that has signalized their piano industry.



View of the Interior of the Chicago Radio Show, Which Was Attended by an Enormous Crowd.

Many sets were exhibited by the High Schools. Lane showed glued up stock cut to length, squared up stock for stator blocks sawed to diameter (drilled and ends turned square and to size), a Sheldon standard receiving set (cost to pupil $4.85), types of Galena ore used in crystal detectors, loose coupler set for eighty-five cents, variometers, condensers; and in the booth of the Tilden High School, V. K. Hazzard, 7030 Lowe Avenue, and L. I. Jones, 1124 East 46th Street, two students, showed their sets, which were as neat and efficient as many sets produced by technical experts.

The Great Lakes Naval Radio School presented an historical exhibit showing some of the oldest and some of the most up-to-date receiving and transmitting sets. They showed a radio compass such as will be used by lake steamers in finding their courses. The Department of Commerce boy and girl scouts and camp fire girls submitted educational displays.

An address of welcome was delivered by J. C. Hail, representing George Carlson, Commissioner of Gas and Electricity for the City of Chicago. Mr. Carlson is credited with making possible the first municipal broadcasting station. Monday's open forum embraced the kind of equipment desired, discussion of the most popular kinds, enumeration of the difficulties encountered in the manufacture of radio parts, problems of the future and elimination from the field of such apparatus as has been found unreliable. Only bona fide manufacturers were permitted to attend these discussions of the open forum.

Paul A. Westburg, president of the Chicago Rotary Club, also of the Westburg Engineering Co., opened the day's formalities Tuesday with an address of welcome to the public, fans and exhibitors in convention. The open forum introduced the topic of present business and future business, fads, and the question of formation of a National Radio Jobbers' Association. "Radio bootleggers" were denounced by A. H. Redden of Irvington, N. J., and A. P. Scanlan, of Newark, N. J., two of the advance guard exhibitors who came in early. They represent the Wireless Specialty Apparatus Company of Boston, a concern claiming to have the only licensed crystal detector in the country.

"We are not going to interfere with this exposition, or any other radio show or exposition, but we want the manufacturers, jobbers, dealers, and the public to know the truth about this situation. The Wireless Specialty Apparatus Company has the basic patent on crystal detectors dating back to 1908. This is the only licensed crystal detector in the country. We have written to every manufacturer, jobber and dealer informing them of the facts and warning them against infringement. The selling of cheap, useless radio sets is doing the industry a great deal of harm. The sooner the real men in the business get together and rout the bootleggers the sooner will this infant industry become stabilized."

Wednesday's forum brought out talks on radio prices, deliveries, the maintenance of newspaper interest, assuring permanent demand, dealer service to customers—a very vital subject indeed, for such service is badly neglected—and an effective method of reaching the farmers.

Thursday was Farmers' Day. Radio broadcasting and what it has done for the farmer, and the importance of relative material broadcasted were discussed.

Friday signalized the meeting of civic industrial radio clubs of Chicago, and discussions of value over making Chicago the radio center of the world were carried on by various speakers. Possibilities for broadening the field of manufacturing radio apparatus were also discussed.

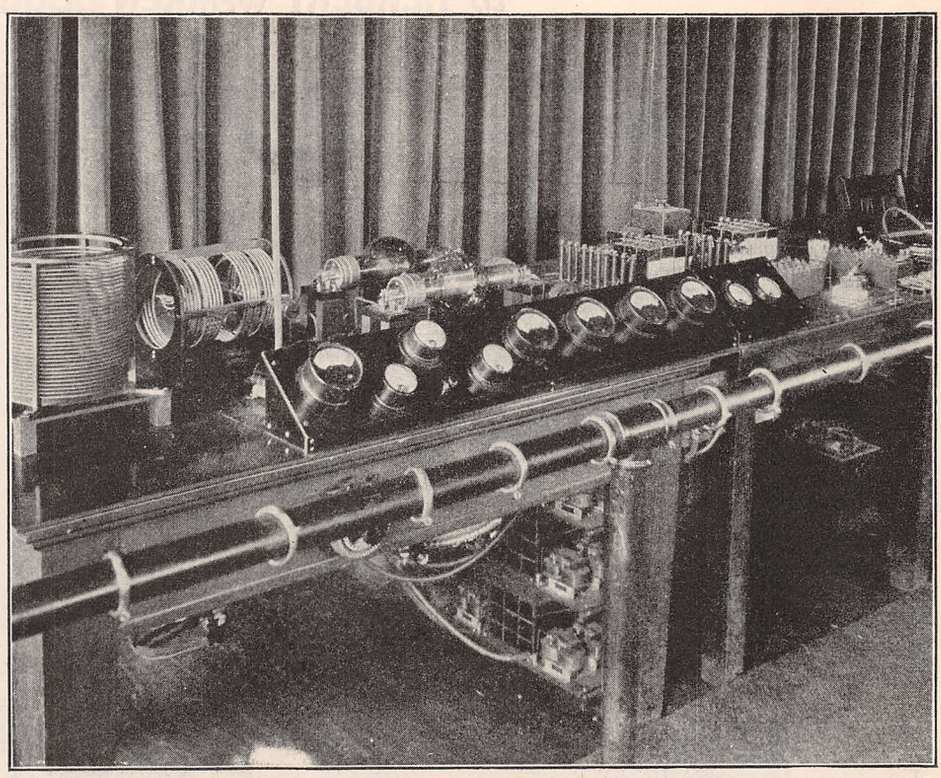
Alexander Eisemann, president of the National Radio Chamber of Commerce, addressed the convention from New York City. He said that quantities of radio apparatus are made to sell but not to use.

"Radio factories are springing up all over the country," Mr. Eisemann said, "and thousands of manufacturers, without previous experience, are building what they call radio

(*Continued on page* 539)

Broadcasting Station WGR at Buffalo, N. Y.

THE radiophone broadcasting station WGR of the Federal Telephone and Telegraph Company, Buffalo, has only been in operation since May, 1921, but has become very familiar to amateurs in that neighborhood. The officials of the company are continually endeavoring to improve the station and many special devices have been incorporated so that various types of voice and music can be transmitted most effectively. The station is continually heard in the daytime at Rochester. The studio in which the performances are given is very well-appointed and sound-proof. A very elaborate system of sound-proofing prevents any noises from the outside affecting the microphone. The antenna consists of a 6-wire cage 3′ in diameter and is erected between two 40′ steel masts on the roof of the factory. The antenna is approximately 80′ from the ground. The ground connection is made to the water and steam pipe system in the factory, and additionally, a direct copper ground is secured to large copper plates buried in the factory courtyard. Large bakelite panels are used where the antenna passes through the walls of the building. As the fundamental wave length of the antenna is approximately 305 meters, no series condenser is required to transmit on 360 meters and consequently, excellent radiation is obtained. The transmitter has a power input of about 1 kilowatt and is supplied by 2000 volt direct current generator, directly coupled with a single phase 25-cycle induction motor operating on the power line. The major portion of the commutator ripples is eliminated by the use of high voltage condensers and iron core chokes; about 37 henries of inductance are used in this filter system and are so distributed that the filter is alternately inductive and capacitive from the generator to the vacuum tubes. The generator is further protected from radio frequency surges by the insertion of high frequency chokes throughout the line. A speech amplifier with two tubes is used between the microphone and the modulator system. These tubes are coupled by resistances. The power tube filaments are operated on 60-cycle AC. but the amplifier filaments are supplied with current by means of storage batteries. Plugs and jacks are used for the voice-control circuits. Meters are supplied for the measurement of the antenna current supply voltage, the currents to the several tubes, both plate and grid current. The meters are mounted on the set to permit constant observation by the operator. For the various types of reproduction, several different microphones are used. For ordinary speech and announcements, the common carbon microphone is used and for special types of transmission, a magnetic microphone is used in connection with considerable additional voice frequency amplification. A small receiving set is mounted near the transmitter which permits the operator to check the modulation. A test of this set indicates that the efficiency beween the direct current generator and the antenna is approximately 48 per cent. Reports have shown reliable daylight communication over approximately 150 miles. The greatest night range of this transmitter reported as yet, is 750 miles, but it is believed that if the operation of the station continues, signals will undoubtedly be transmitted over considerably greater distances than this.



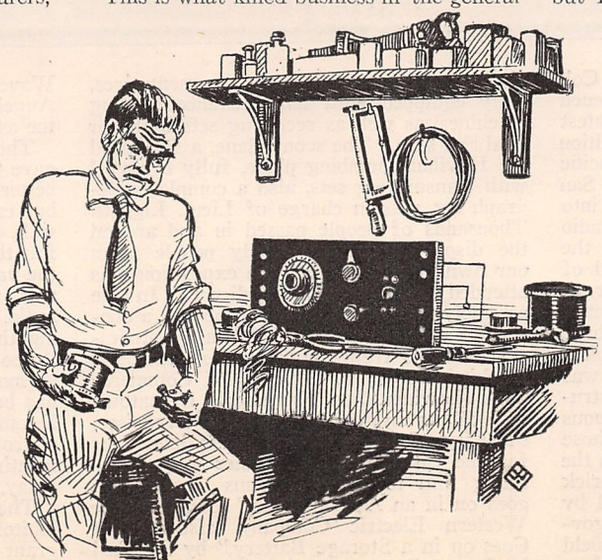
View of the Transmitting Apparatus of the New Broadcasting Station. The Arrangement Is Unusual and Convenient.

Why Radio Sales Fall Off

ONE of the biggest advertising agencies in the country recently gave publicity to the fact that most manufacturers, when planning to put out a product, have their advertising man go through the plant and study in detail very carefully every feature of manufacture. There they stop. They proceed to advertise what their product is and what it will do. This agency pointed out, however, that the sad part of it is that most of these manufacturers and their advertising men do not know how their material or service is actually adapted to the average home because no attempt is made to study the home or the demand.

I think we have had a very fine exhibition of this in the radio business. Here is a thing that can be made a real business, but with the first sign of interest on the part of a public that has money and has been holding it because of the very thing I have cited above, the radio manufacturers and retailers proceed to go at it in the old way and turn out their products without any knowledge of what those interested in the same really think or want. The idea has been to turn out everything possible, put on all the charges possible, and let the devil take the hindermost.

This is what killed business in the general field and it is what will successfully kill the radio business. It is all right to lay it to static, but I think when September comes, unless the radio manufacturers and retailers change their methods, they will find that the public is also static.



Did This Happen to You? You Have Wired Your Instrument After Several Hours' Work, and Then in Placing the Knob the Set-Screw Breaks!

For instance, in addition to opening your columns to manufacturers, why don't you invite the amateurs to write in and tell you their troubles?

To give you a fair example, I will cite my own case, which has been duplicated in various ways among all my friends, and possibly you may find it worth while to let a few manufacturers know what the novices and amateurs have been up against, due to the ignorance of the manufacturers and retailers. For instance, when my interest was first excited I proceeded to write for all the catalogs that were advertised. Sums ranging from two to thirty-five cents were called for. I sent this money which totaled up to several dollars. Some of the catalogs I never received. In some cases, I received post-cards that the catalogs would come later, and for some of these I am still waiting. In other cases I got a few small pam-

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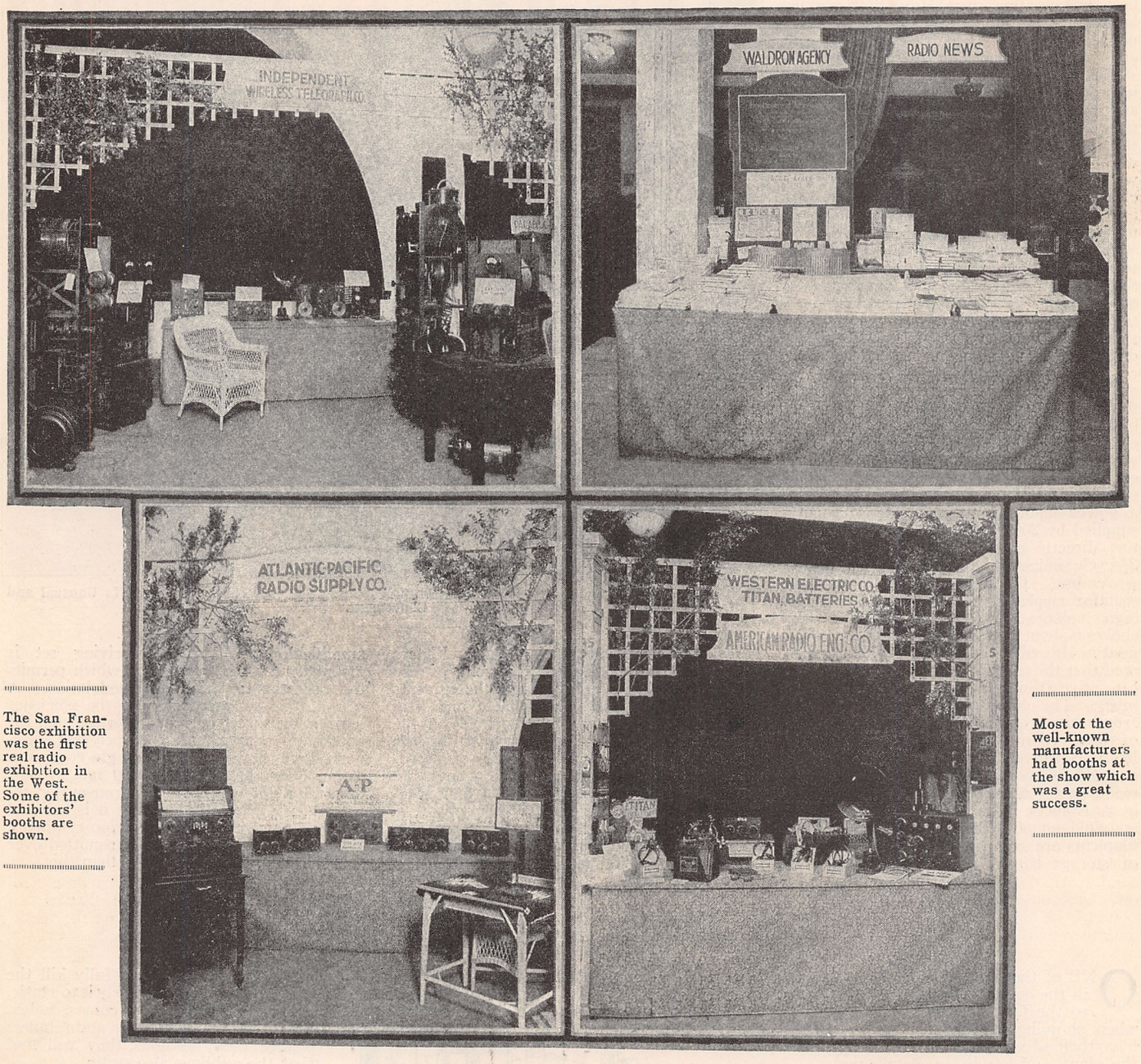
The San Francisco Radio Show

By HERBERT WARREN DODGE



The San Francisco exhibition was the first real radio exhibition in the West. Some of the exhibitors' booths are shown.

Most of the well-known manufacturers had booths at the show which was a great success.

ON Monday, June 12, 1922, Col. George C. Filmer, formally opened not only the first, but the greatest and most complete radio exposition ever conducted on the Pacific coast. Mayor James Rolph, Jr., of San Francisco, pressed the button which put into motion the most wonderful exhibit of radio merchandise. As a fitting climax to the formal opening the Hella Temple Band of Dallas, Texas, conceded to be the crack band and drum corps of the entire organization, rendered an hour's band concert. All available space was taken shortly after the first announcement was published, and the display of radio instruments was from the world's most famous and largest manufacturers. Among those exhibiting, creating unusual interest, was the radio compass designed by Dr. Frederick A. Kolster of Palo Alto, and exhibited by the Federal Telegraph Company, the government booth displaying the radio field sets of the Bureau of Commerce Navigation, Mare Island Navy Yard booth, in charge of the navy yard representatives, fully equipped with long distance sending machines, as well as receiving sets both for land and ship. The scout plane, a full sized De Haviland bombing plane, fully equipped with transmitting sets, also a complete telegraph set, was in charge of Lieut. Liggett. Thousands of people passed in and around the display booths, not only people from our own community but the exposition was attended by a national audience. In the assembly hall which seats 750 people, a continuous entertainment was given by professional artists from the bay cities. Through the kindness of the Chamber of Commerce films showing "San Francisco's Chinatown with all its mysteries," and "San Francisco, the City of Enchantment" were loaned us for the entire week. Another very interesting film to all radio fans was "What goes on in an Audion Tube," loaned by the Western Electric Company, also "What Goes on in a Storage Battery," by the Earl P. Cooper Company, and known as a Prestolite film; "Transmitting of Wireless Waves," from the Bray's Studio of Los Angeles. These films were used by us in the assembly hall during the radio show week.

The result of the Exposition not only gave the public the opportunity of becoming better acquainted and familiar with radio, but each exhibitor derived great benefits as well, and all feel it more than repaid them for their efforts. Each man in charge of the various booths was only too glad to give any information to those interested in radio. Free demonstrations were held during the week. Broadcasting stations heartily co-operated with us. Today radio is uppermost in the minds of young and old, and has been advanced to the point where it is becoming as popular in the home as the victrola. It is the amateur and his experimenting that have put radio where it is today.

The many letters coming in from the exhibitors as well as the verbal comments, grant to Mr. Mauzy the honor of bringing together the first real radio exposition ever attempted in the West.

In the New Era of Radio

By LEE de FOREST, Ph D., D. Sc.

IN a recent magazine I saw a picture whose message so appealed to me, to my once youthful experience, that it now hangs framed on my laboratory wall. It depicts a little hut, standing alone in a canyon in the moonlight. From a nearby tree a small aerial leads to the roof, a light shines from the cabin's window, and in its glow stands a youth, head bare, with head phones on ears, their cord leading into the open window. He stands there with open mouth, hands outspread in silent ecstasy and wonder, looking upward into the sky of stars. "In Tune with the Infinite" is the title of the picture, and no artist who had not himself felt the thrill of listening in the quiet night to the etheric music of some distant radiophone could ever have conceived that picture or have painted it so wistfully well.

It will not be years now, nor many months, before the necessary high-power broadcasting stations will be planted in all our cities, each covering a sufficiently wide area to enfold the entire land in a mantle of music, to breathe into every ear which cares to listen voices of comfort, of nightly companionship with the world's doings and the world's best minds. "Just a song at twilight"—but its lovely echoes shall be heard in the miner's cabin, in the rancher's hut, in the living-room of the old farmhouse; over the mountain range, beyond the desert, across the silent prairie, over the wastes of sea. And who can say what emotions are not awakened, what souls that were deadened, what hearts long embittered by loneliness, will not be stirred to a new life, a new outlook, by that sound?

I for one have no patience with those (few, I believe) who regard radiophone broadcasting as a "fad"—an ephemeral excitement which, like Tiddledewink or Diabolo, will interest the youth of the land for a few months, to be then cast aside for a new toy. The "new toy" was what the skeptics of the day called the telephone of Bell. Surely those who so designate the radiophone fail at the outset to see the true significance of this invention, the true service radio communication now stands ready to perform. The engineers have done their work. Now all that we need is its application to the purpose of life.

IN THE FIELD OF EDUCATION AND ENTERTAINMENT

When one seriously considers the human side of this broadcasting idea, and its possibilities, he must admit that it possesses potentialities for universal education, and for all the train of good which results from universal education, which can be compared only to that brought through the past five centuries by the art of printing. Only this new revolution will grow to maturity in a decade instead of 500 years—a graphic commentary on the acceleration of man's present progress.

I have for a long time maintained that this educational value of radiophone broadcasting will prove by far its greatest worth—to the people of our country—and later of all nations. No doubt, just now, the entertainment feature is the most striking, the phase most appealing to the popular desire, naturally enough. Unquestionably the fine programs which are being given by the large broadcasting stations are accountable for the astonishing spread of receiving stations during the past eight months. As experience trains the directors these programs will become better, more wisely selected, more artistically arranged.

In this respect we can expect to repeat the history of the moving-picture art. Much of our present radio programs are comparable to the moving pictures of the small "nickelodeon "theaters twelve years ago—before the fine, artistic "feature films" were conceived or executed.

STORY TELLING IN RADIO

Similarly we may look forward ere long to the big features of radio entertainment, as for example the mystery serial story—written or arranged especially for the radiophone—spoken by a trained voice, stopping (like most serials) at a tantalizing point in the story, which leaves a million hearers in breathless suspense—and insures their impatient presence at the home radio set every night, that they shall miss no link in the well-told tale.

Thus it is possible quite a new type of story and storytelling will originate, to serve the *ear* as does the serial film the *eye*. And I say quite confidently that no National Board of Censors will ever be needed to insure that only good and worth-while tales will be told from the radiophone centrals.

THE RADIO NEWSPAPER

The comparison of radio broadcasting to the introduction of the printing press is not too bold. When newspapers and newspaper syndicates realize its full possibilities in their own fields, this comparison will become concededly commonplace. The editors now have a medium where antennæ wires take the place of Mergenthalers, ether waves of ink and press paper, head phones of spectacles, and ears of eyes! Of course the pennies to the newsboys are quite lacking, and let us sincerely trust that we shall have special wave-lengths reserved for the advertising pages of the new *Radio Newspaper*. The new methods of news distribution, too, have advantages which will certainly more than compensate the newspaper owners for their lack of revenue. At least this will so prove for the larger papers, the news associations. The news brevities which are radiated reach millions of listeners while the news is really new, and where the daily metropolitan sheet can never come until too late. A whetting of appetites to buy next day or later a paper for the purpose of reading further details will result in new revenues. The influence of a newspaper can be greatly increased by its "radio edition"—already attested by the zeal with which so many now are clamoring for radiophone transmitters for broadcasting purposes.

Broadcasting, both of editorials and of news, will prove here also a genuine benefit to the newspaper as well as to the public. And yet it was actually less than a year ago that the management of one of our leading New York papers after having inquired regarding the possible advantages which might accrue to that paper by being first in the radiophone newspaper field, and having obtained prices on a one kilowatt installation for their New

(*Continued on page* 557)

(*Illustration by courtesy of "Judge"*) IN TUNE WITH THE INFINITE

Radiophone Broadcasting in France

The Rectifier Used in the Phone Transmitter at the Eiffel Tower.

THE broadcasting fever seems to have seized Europe and for the last few months the Radio business has been growing rapidly on the other side of the Atlantic. In England, broadcasting stations are being erected, in various areas, which will broadcast regular programs and information of all kinds, as it is now being done in the United States. In France, so far, only two broadcasting stations exist, but they are of the high power type and everybody may receive the broadcast, even with a very simple receiver.

One of these stations, which is operated by the Signal Corps, is installed at the Eiffel Tower radio center in Paris, and thanks to the very large aerial supported by the 1,000′ tower, the concerts are easily received all over France and in adjacent countries. The other station, which so far only sends occasionally without any schedule, is installed at Ste. Assise, about 25 miles from Paris, where is also erected the largest Radio station in the world, actually in operation.

Up to the present time, the Eiffel Tower broadcasting station has been more or less in the experimental stage; but recently the transmitter has been modified and the power increased and it has occurred to us that a description of it, as well as of the method of reception used on the other side, might interest our readers.

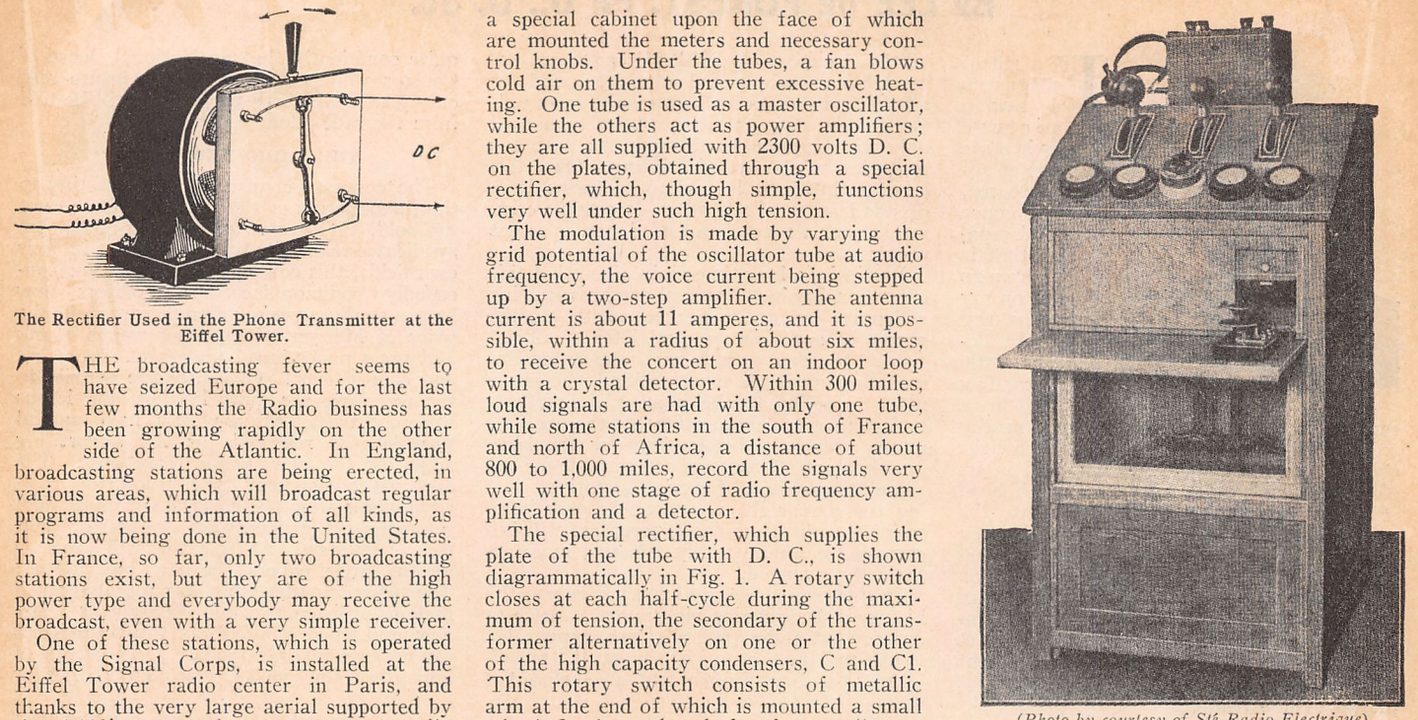
THE TRANSMITTER

The Radiophone transmitter, which is now in use, consists of 12 vacuum tubes of large size, with a switching arrangement so that only six tubes may be used, if desired. All of the tubes are supported on a special cabinet upon the face of which are mounted the meters and necessary control knobs. Under the tubes, a fan blows cold air on them to prevent excessive heating. One tube is used as a master oscillator, while the others act as power amplifiers; they are all supplied with 2300 volts D. C. on the plates, obtained through a special rectifier, which, though simple, functions very well under such high tension.

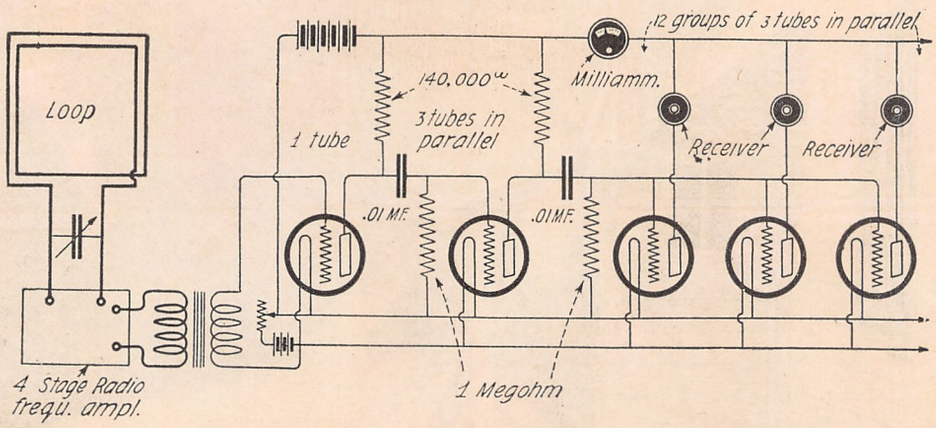
The modulation is made by varying the grid potential of the oscillator tube at audio frequency, the voice current being stepped up by a two-step amplifier. The antenna current is about 11 amperes, and it is possible, within a radius of about six miles, to receive the concert on an indoor loop with a crystal detector. Within 300 miles, loud signals are had with only one tube, while some stations in the south of France and north of Africa, a distance of about 800 to 1,000 miles, record the signals very well with one stage of radio frequency amplification and a detector.

The special rectifier, which supplies the plate of the tube with D. C., is shown diagrammatically in Fig. 1. A rotary switch closes at each half-cycle during the maximum of tension, the secondary of the transformer alternatively on one or the other of the high capacity condensers, C and C1. This rotary switch consists of metallic arm at the end of which is mounted a small wheel fixed on the shaft of a small synchronous motor. This wheel, turning in synchronism with the alternating current, touches at each turn two contacts mounted at 180 degrees from each other and formed by two steel wires about 1/32″ diameter. They are made in the shape of an arc and so mounted on a bakelite panel that they may be moved around the center, so that their positions are adjustable in relation to the current phase.

As the condensers are always charged in the same direction, they constitute a source of D. C., which, smoothed by the proper choke coils, do not produce any ripple.



(Photo by courtesy of Sté Radio Electrique)
French 200 Watt Radiophone Set Which May Also Be Used for C. W Transmission.



Hook-Up of the Receiver Shown in the Picture Below. The Twelve Receivers May Be Tuned for Various Frequencies so That All Sounds Are Well Reproduced.

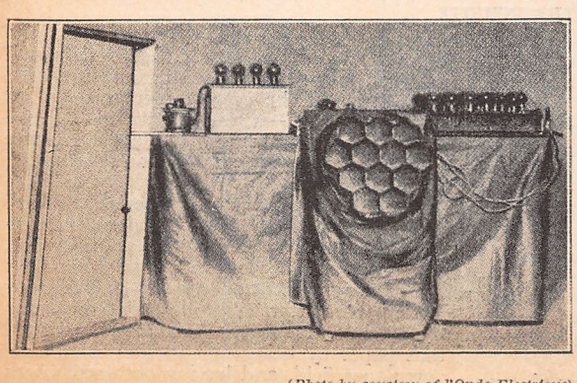
HOW CONCERTS ARE HEARD

As the wave-length used for the transmission is 2,600 meters, it is possible to utilize resistance amplifiers for the reception of the broadcast. It has been found that in the majority of cases, they gave much better results for the reception of telephony than the usual type of transformer coupled amplifier, no distortion occurring, as is often the case with iron core transformers, which are not designed especially for this kind of work. This fact has been confirmed by numerous amateurs in France, England, Belgium, Holland, Switzerland and Italy.

At 180 miles from Paris, an ordinary tuning coil with galena detector connected to a three-wire aerial 200′ long and 60′ high, has given excellent results. At Geneva, Switzerland, 315 miles from the transmitting station, very loud signals were reported, the receiving set being an ordinary regenerative receiver with one tube; the antenna in this case consisted of two wires, 180′ long.

At Edinburgh, Scotland, 725 miles from Paris, the speech and music could be heard 12′ from the phones, with a receiver consisting of one stage of radio frequency, detector, and two stages of audio frequency amplification. The antenna in this case consisted of the standard amateur aerial, permitted by the English Post Office, which is 100′ long, one wire. In Italy, at Milan, 400 miles away, an amateur receives every day on a loud talker the music from the Eiffel Tower. The receiver is of the re-

(Continued on page 561)



(Photo by courtesy of l'Onde Electrique)
A Complete Receiving Set Used for a Demonstration in a Large Auditorium. On the Left is the Loop Aerial and in the Center the Special Loud Speaker.

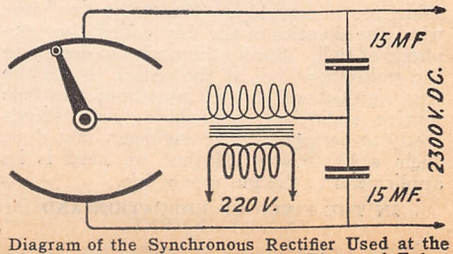
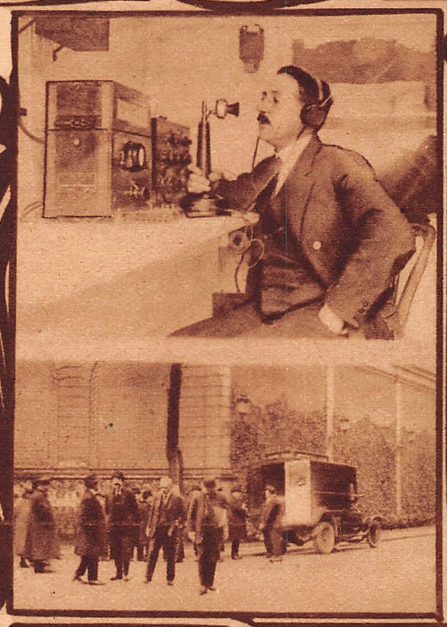


Diagram of the Synchronous Rectifier Used at the Eiffel Tower Station to Supply the Plates of Tubes with 2300 Volts D. C.

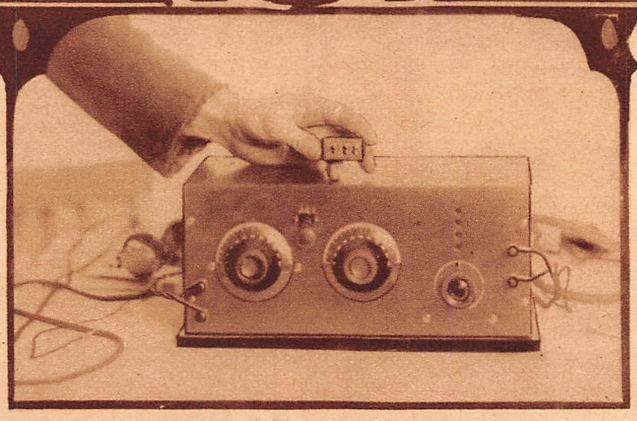


Above (Left) P. D. Powell, of the Bureau of Standards, Has Evolved a Radio-Receiving Set in Which the Usual Batteries Are Eliminated and Necessary Current Obtained from Electric Light Line. It Is Claimed There Is No Hum.

(Photo by Underwood & Underwood)

Above (Right) General Pershing Visits Home of Dr. James H. Rogers, Paying Tribute to Inventor of Underground and Underseas Radio.

(Photo by Fotograms)



Above: Paris Has Inaugurated Its First Police Radiophone Patrol. The Truck Is Fitted with a Phone Transmitter and Receiver and by This Means Can Keep in Touch with Headquarters at All Times. Photo Shows he Truck, Also Interior View of the Phone Station.

(Photo by Kadel & Herbert)

Above: Senatore Guglielmo Marconi in the Radio Room of His Yacht, "Electra." The Loop Was Probably Used in Attempts to Receive Mars.

(Photo by Fotograms)

Left: Miniature Reservers Are the Vogue. The Small Size of This Latest Creation Is Demonstrated when It Is Compared with an Ordinary Receiver.

(Photo by Kadel & Herbert)

General Pershing Visits Radio Inventor

Gen. John J. Pershing recently paid a visit to the laboratories of Dr. James Harris Rogers, inventor of underground and underseas radio, and, incidentally, congratulated Dr. Rogers on his wonderful work.

General Pershing was accompanied by his staff and the distinguished visitors were introduced to Dr. Rogers by Dr. Clarence J. Owens, lieutenant-colonel in the officers' reserve corps of the army.

In speaking of General Pershing's visit, Dr. Rogers said the general had previously said he would like to visit Hyattsville and listen-in at the laboratory.

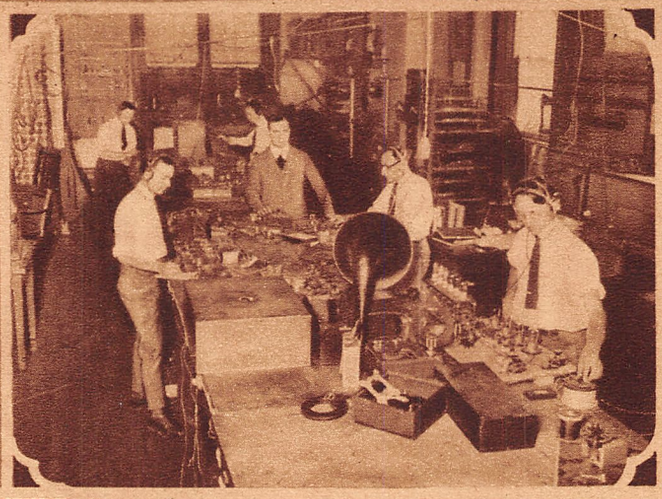
"I was delighted to see the great soldier," said Dr. Rogers, "and consider it a great honor to have had the pleasure of entertaining the general in a modest way. He seemed to be much interested in what he was shown, and I found him to have a charming personality."

Dr. Rogers had completed his discoveries when the United States entered the war. As a patriot he offered his Government the result of his life work as a scientist. Secretary Daniels called upon Secretary Lane to expedite the issuance of patents to Dr. Rogers in the interest of the Government during the war crisis. The patents were issued and stations were installed in many parts of the country and the system placed in submarines.

At the time General Pershing sent his famous message calling for a continuity of communications, the Navy Department met the emergency by the use of the Rogers' methods. It was the crucial moment when cables were being cut, submarines menaced the ocean and when at times other systems were futile, due to static interference.

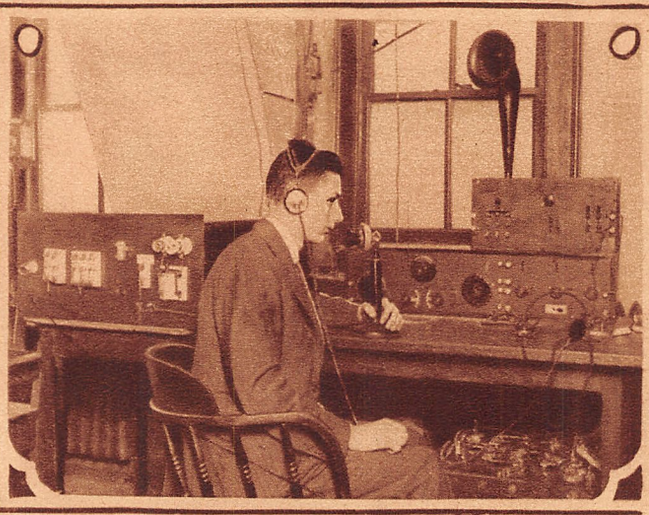
The visit of General Pershing is the culmination of a train of honors conferred upon Dr. Rogers. He was lionized by his fellow citizens of Prince Georges County, and, in fact, the whole country. The General Assembly of Maryland passed resolutions expressing thanks for the services of her famous son, who had "rendered distinguished service to the republic of science." The University of Maryland conferred the degree of doctor of science; the Maryland Academy of Science made him a fellow and conferred upon him the scientific medal, and the achievements of Dr. Rogers are now before the Noble committee in Stockholm.

The Radio Laboratories of New York City College



Below: View of the Radio Station on Board the S.S. "America." This Ship Was One of the First American Passenger Vessels to be Equipped with Radiophone. Communication with Land Has Been Carried on Over Great Distances.

(*Photos by Kadel & Herbert*)



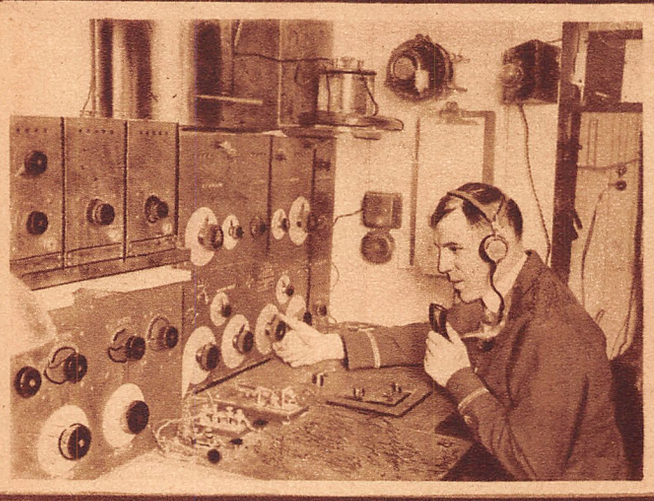
Above (Left): The City College of New York Possesses One of the Most Complete Collections of Vacuum Tubes in the Country. Almost Every Type of Tube is Shown in This Photograph. Professor Alfred N. Goldsmith of the City College is Holding Two Old and Modern Tubes.

Above (Right): Professor Goldsmith and Research Engineers of the College Laboratory.

Left: The Radio Club at the City College is Also Equipped with a Powerful Transmitter. Photo Shows President of the Club Talking to a Distant Amateur.

Below: The Powerful Radiophone Transmitter of the City College, Which is Heard Over Great Distances.

(*Photos by Kadel & Herbert*)



Senatore Marconi Entertained

WELCOMED by scientists and engineers of international note who joined in high praise of his great accomplishments in the field of radio, Senatore Guglielmo Marconi spent a busy day at the plant of the General Electric Co., Schenectady, N. Y., on June 26th, inspecting the big electric works and conferring with the wireless experts of the company and of the Radio Corporation of America.

Senatore Marconi made a special trip as far as Albany in his yacht, *Electra*, and was brought over to Schenectady by automobile, accompanied by a large party of officials of the Radio Corporation, officers of the Italian Navy, the United States Army and Navy and others.

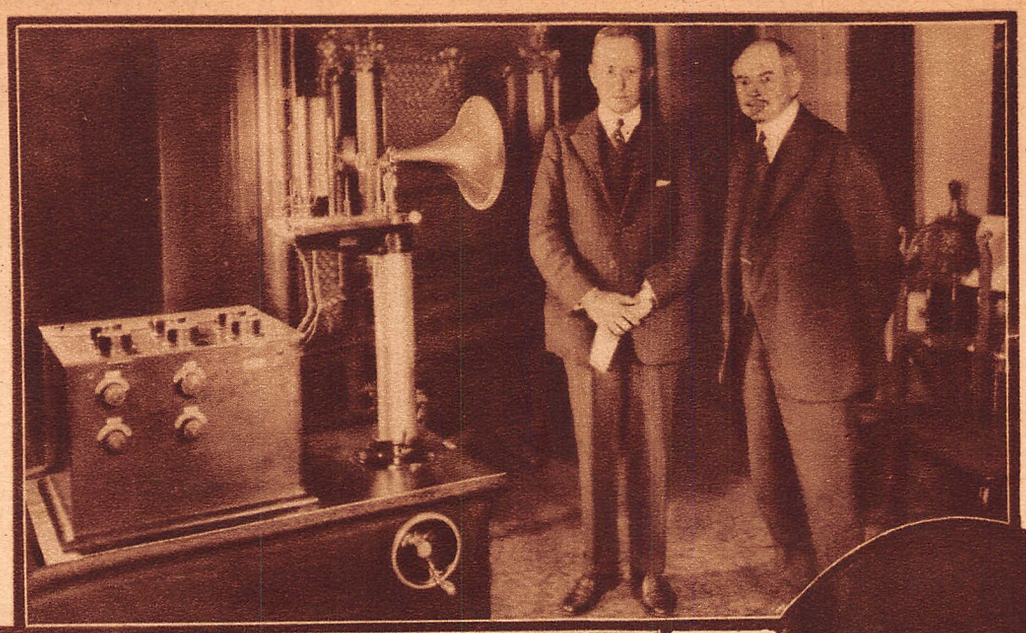
During his visit he delivered a speech on wireless from the Broadcasting Station, WGY, held an informal reception for several thousand Italian residents of the city, attended an informal dinner tendered to him by E. W. Rice, Jr., honorary chairman of the Board of Directors of the General Electric Co., and a luncheon given in his honor by the company. He returned to New York the following day.

The greater part of the distinguished inventor's visit was filled with inspection of the radio manufacturing division of the General Electric Co., its broadcasting station, and an examination of the Research Laboratory.

The spontaneity of the greeting accorded Marconi pervaded the whole city and came not only from the scientific workers who are engaged in engineering problems, but from the lowliest citizen, all turning out to do him honor.

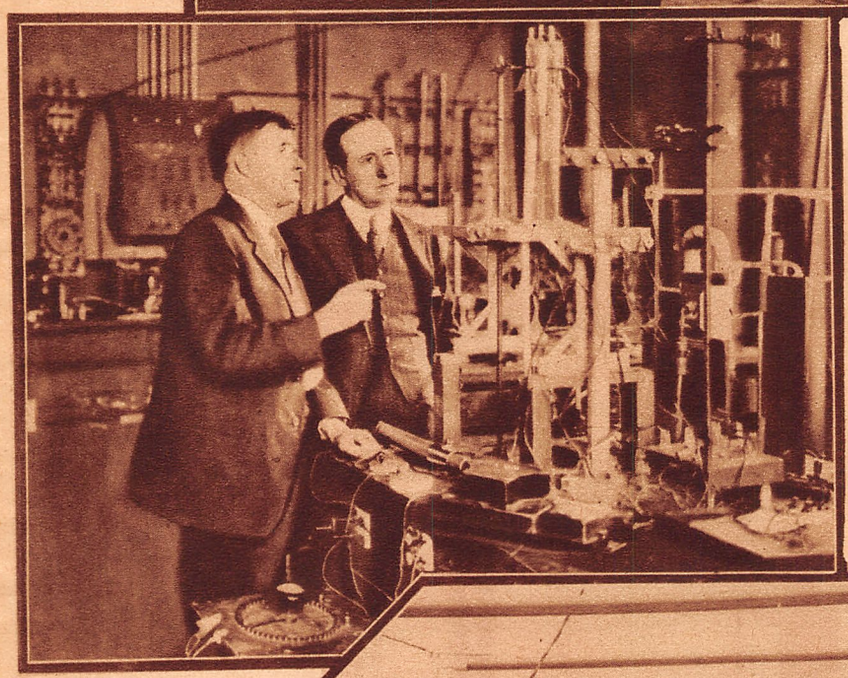
O. D. Young, in a keynote address at the luncheon, classed Marconi with Edison as the "leading inventor of the world." Dr. Whitney and Dr. Langmuir pointed out some of the high spots of his epoch-making investi-

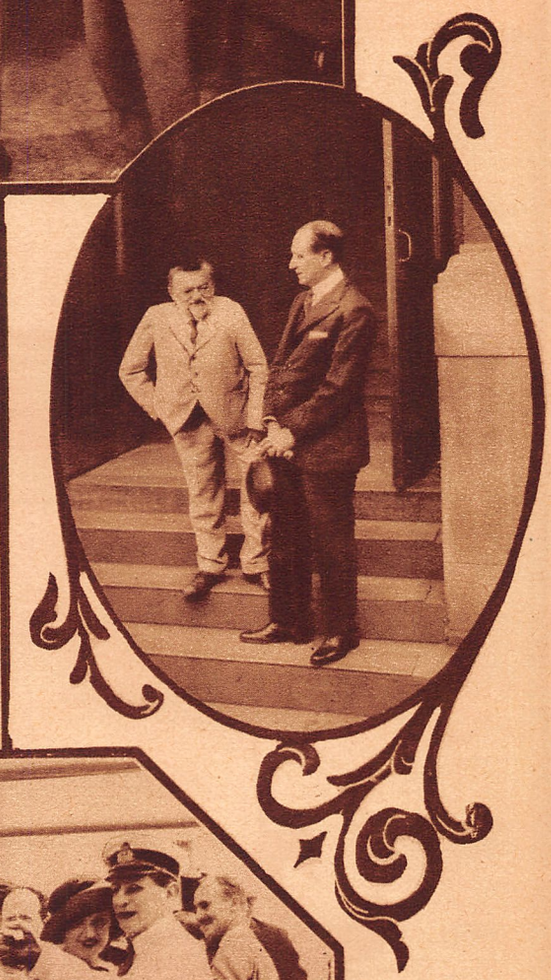
(*Continued on page* 533)

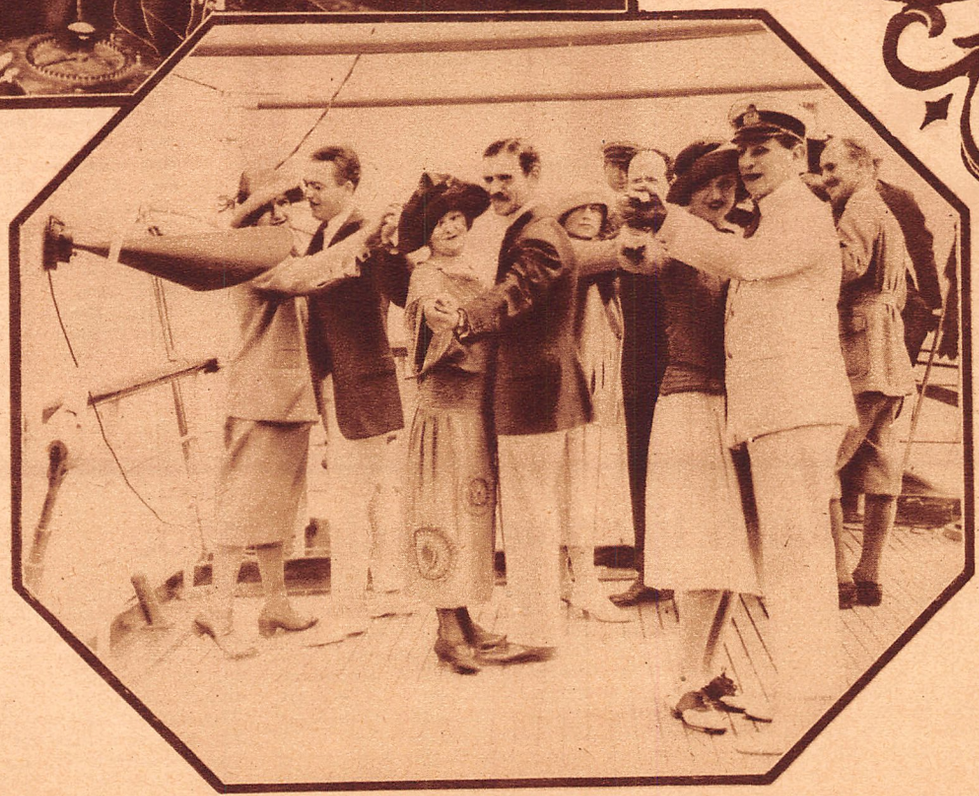


Right: Senatore Marconi After He Delivered His Address by Radiophone from the Schenectady Station, with Dr. Rice of the General Electric Co. Note the Special Type of Microphone.

Below: Marconi Renews His Old Friendship with Dr. Steinmetz of the General Electric Co.







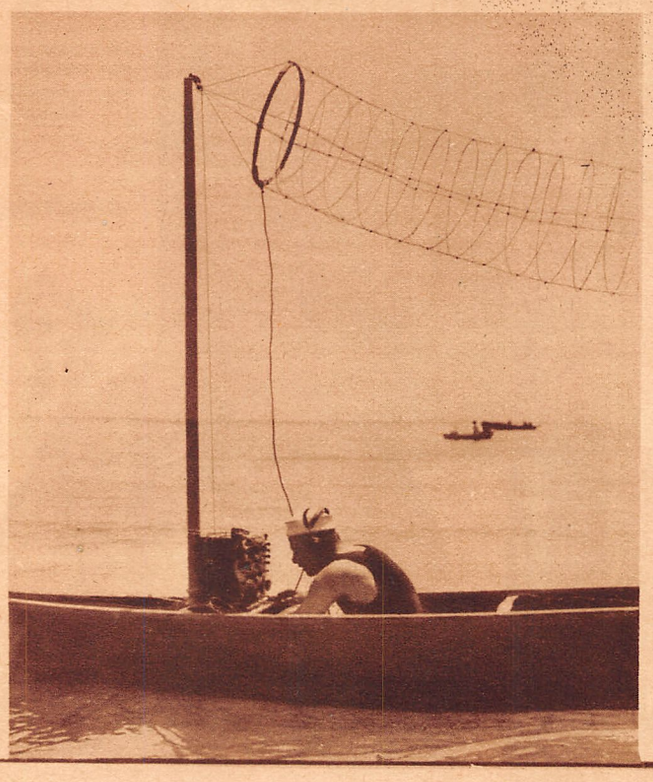
Above: A New Type of High Power Transmitting Tube is Shown to Mr. Marconi by Its Inventor, Dr. Irving Langmuir of the Research Laboratory of the General Electric Co., at Schenectady, N. Y.

(*Photo by P. & A.*)

Left: A View of the Guests on Board the yacht, "Electra," Dancing to the Tune of Radiophone Music. Senatore Marconi is Seen Dancing to the Right in White Uniform.

(*Photo by K. & H.*)

Radiophone Experiments on Canoe



Rody, One of Our Friends, a Member of the Radio Club of Brooklyn, Is Spending Most of His Vacation This Year In a Canoe. But He Couldn't Be Persuaded to Leave the Radio Set Home, So He Dragged It Along. He Rigged Up the Canoe With One of the New Types of Aerials Which Are Said to Be Quite Efficient, Especially for C.W. With His Low Power Radiophone, Rody Is Making a Series of Tests. At His Home In Sheepshead Bay And At the Stations of Various Friends In Brooklyn, Records Are Being Kept of the Results of His Tests. Considerable Success Has Been Obtained And Rody Will Probably Work Out a Design of Set For Use On Small Yachts.

Nauen Improves Radio Station

THE powerful wireless station of Nauen is being greatly extended in order to equip it for a larger volume of traffic with the United States and the development of traffic with Argentina. The Trans-Radio Company has decided to raise additional capital of 25,000,000 marks (nominally £1,250,000) for the undertaking, and a beginning has already been made with the constructive work. The plans include the erection of seven new masts, each 210 meters (689 feet) high, and the dismantling of four of the existing masts.

Hitherto there have been two sets of antennæ in use at Nauen. The A, or main sets, for use in the service with the United States, were carried on six masts, two principal masts each 260 meters (864 feet) and four secondary, each 125 meters (416 feet) high. The B set, for the European service, is carried on three masts, each 150 meters (500 feet).

The two main masts of the A set are of interesting construction, the upper 150 meters of each forming an insulated topmast. The new masts will presumably be of similar construction. The grouping of the antennæ is to be altered. At present the A antennæ consist of a double spread of five wires stretched in a straight line over the masts, the distance from end to end being 2,484 meters (one and a half miles). The B antennæ are placed at right angles to them. The station buildings are exactly in the center, so as to receive the leads-in of both. In the new scheme the antennæ are to be so arranged as to be capable of coupling up into a variety of combinations so as to be adjustable to the needs of different traffic.

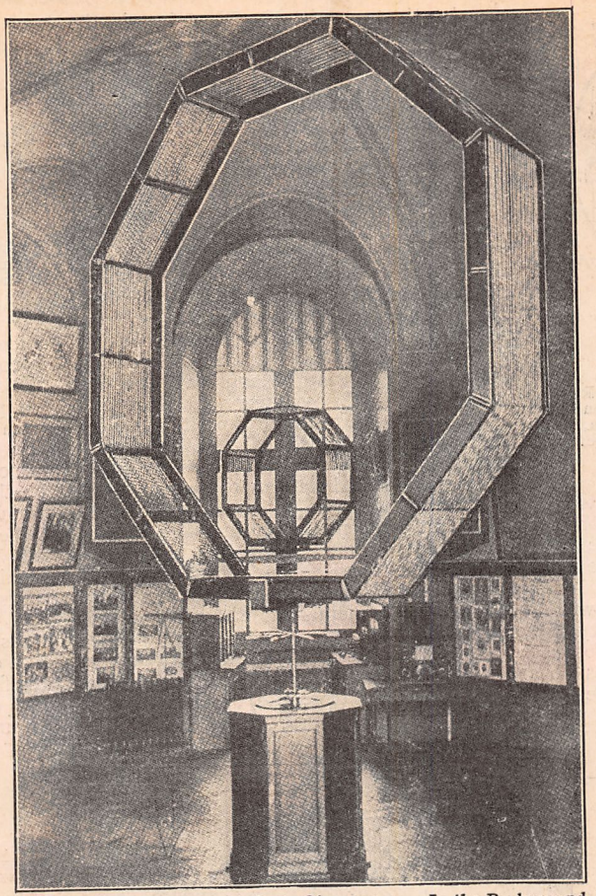
(*Continued on page* 532)

Paris Observatory Checks Time Signals of the World

AMONG the useful applications of radio is one which presents much interest for the astronomers; it is the use of time signals for the comparison of two clocks located at a great distance from each other. The location of a certain spot on the surface of the earth necessitates the measurement of two astronomical observations of this particular spot, the latitude and the longitude. The latter is nothing else but the difference between the local time of the spot and the meridian of origin at a given distance.

A very complete study of this particular application of radio has been made in France and several measurements have been already made since 1910 in different parts of the world. This method which is now well-known, allows the astronomers and map-makers to determine the position of a spot, in an uncharted country, within a few yards. This system is also used in the determination of the speed of electro-magnetic waves over the surface of the earth; the comparison being made between two distant stations equipped with precision clocks measuring the thousandths of a second, the signals being recorded through a special apparatus having practically no inertia and measuring instantly without introducing any delay which would make the measuring inaccurate. The speed found by this method was 183,922 miles a second.

In order to check the time signals sent out by the various high power stations of the world, the Paris Observatory has installed two receiving sets with loop antenna and recording apparatus, so that the clocks in use may be checked every day, on time signals sent thousands of miles away. In the determination of longitude by a party of explorers going into the wilds of unknown countries such as the unexplored parts of Africa, special portable sets are used enabling the astronomers to receive the time signals from different stations and make the necessary measurements for the location of the meridian. The limits of commonwealths in Australia have been determined by this method within accuracy of a few yards. This has been most useful as, in some cases, the lines were passing through private properties and mining districts. The owners had previously been in constant warfare regarding the property of the ground, and the position of the limit line.



The Radio Apparatus at the Paris Observatory. In the Background May Be Seen the Receivers and Recording Instruments.
(*Photo by courtesy of l'Onde Electrique*)

At the Paris Observatory, in order to have the most accurate results in the reception of time signals, a special chronograph is used with a recording system consisting of a strip of paper passing under wheels which prints with an accuracy of one-thousandth of a second, the time signals received. The comparison may also be made by means of the telephone receivers when static or other disturbances prevent the recording apparatus to function properly.

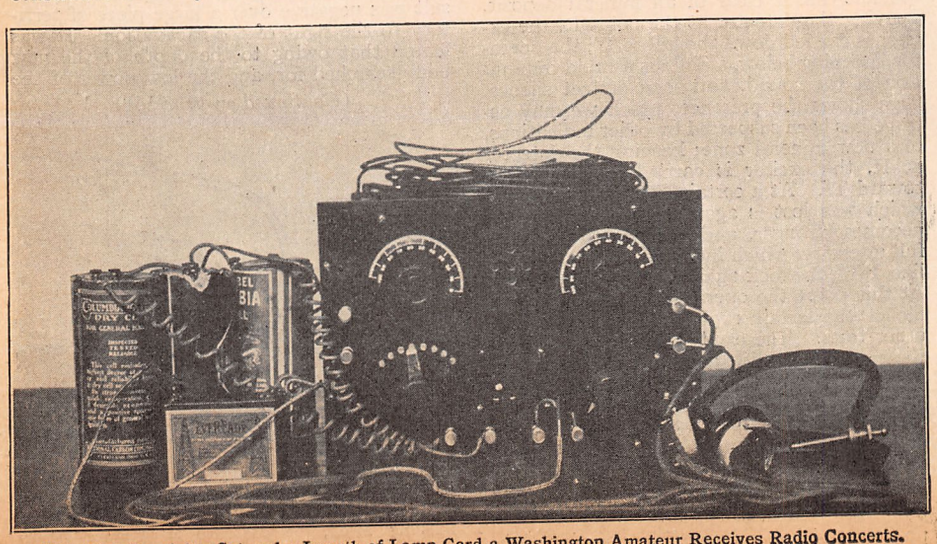
The apparatus are of different types including a resonance and a resistance amplifier, selective circuits for the elimination of interference and statics and synchronism system attached to a clock for comparison of the local and received time signals.

A New Type of Aerial

By S. R. WINTERS

BY a peculiar "hook-up" of the innards of a compact radio-telephone receiving set, the details of which are being withheld from the public for obvious reasons, Fred May, a radio amateur, residing at 713 Mt. Vernon Place, Washington, D. C., has recently demonstrated his ability to receive wireless signals on short wave-lengths in the absence of "ground" connection when the conventional antenna has been dispensed with. Fifty feet of lamp cord or other insulated wire constitutes an oddly-formed aerial. Application for a patent protecting his "hook-up," which he claims is a departure, is pending.

The receiving outfit in its entirety, including the aerial, is shown in the photograph herewith reproduced. Only one electron tube is employed, which serves in the two-fold capacity of detecting and amplifying the incoming radio-telephone signals. The cabinet, compactly built, is 8 by 12 by 6 inches in size. Three dry cells are the source of electric potential for the operation of this wireless receiving unit. Communications have been readily copied when employing only eleven volts on the plate circuit, whereas twenty-two volts are commonly put into service. The outfit was specially designed for use on a 360-meter wave-length, although "WWX"—the United States Post Office Department wireless station—may be copied when transmitting on a wave-length of 1,160 meters.



With This Receiving Set and a Length of Lamp Cord a Washington Amateur Receives Radio Concerts.

Friends of this wireless enthusiast apply the word "magic" to the performance of his nifty receiver when by merely making the ordinary connections with the knobs visible on the cabinet, and throwing the fifty feet of lamp cord on the floor or elsewhere, radio-telephone signals may be audibly heard by adjusting the phone receivers to the ears. The cord or insulated wire does not require a pre-arranged formation, it being merely placed in any fashion on the floor or in any other convenient place. The "hook-up" was not only conceived by Mr. May but the cabinets and other parts fashioned into the snug manner which the illustration reproduced indicates. His design aims to outwit landlords and city authorities whose stringent regulations would prohibit the construction of a towering antenna or aerial from houses and apartments in the city. The service of this outfit is ordinarily restricted to local broadcasting stations—those located within the boundary of a town or in proximity thereto—and long-distance reception cannot be reasonably anticipated. Freak performances, to be sure, are occasionally demonstrated by wireless equipment no less than individuals.

Radiogeoscopy

By UMBERTO BIANCHI

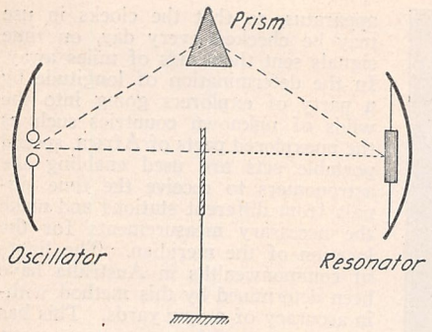


Fig 1

This Diagram Illustrates the Phenomena of Radio Waves. A Grounded Metal Shield Between the Transmitter and Receiver Prevents Reception, but the Waves May be Reflected to the Receiver by Another Body of Metal.

A NOTABLE contribution to the technique of researching and definition of the area of mineral masses in subterranean sections is based on the use of the Hertzian waves.

The Hertzian system is based on the well-known phenomena of the impermeability of good conductors to electric lines of force. A Hertzian oscillator (Fig. 1) produces no phenomena of resonation, because of the interposed grating. The resonance, on the other hand, is developed with the aid of a reflector or prism and the oscillations are carried to the resonator.

Let us now assume the case of a hill, on whose side outcrops of minerals have been found. Wishing to determine how important the deposit might be, it would be necessary in the first place to make some preliminary drifts to determine the extent of the outcrop and some shafts for determining its depth. Both of these operations could be avoided by using the apparatus for dirigible waves. Placed at the point T (Fig. 2) is the emitter, and in R the detector, and it is found that along the line TR no impediment exists to cut off the waves; but if the detector passes from R to R^1 the telephone of the detector itself is silent because the waves emitted from T meet the mineralized mass, which acts as a shield. If the detector is placed in the third position, R″, so that the line TR″ passes below the mass, the telephone will produce a sound.

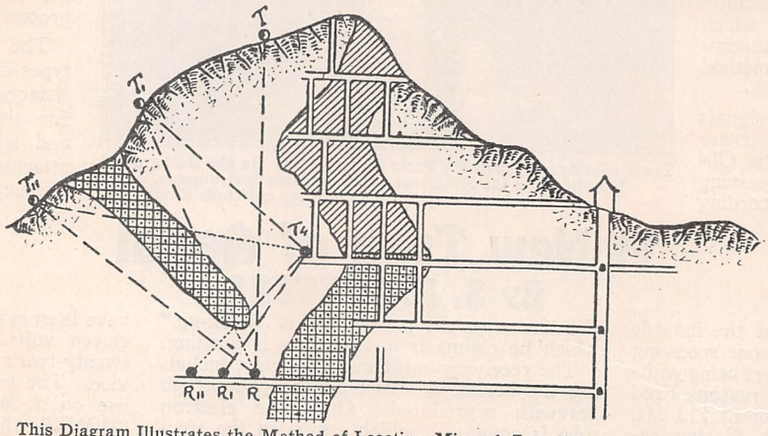
This species of introspection is carried on by shifting the exciter along from T to T″, while the detector remains at R″; again the waves are intercepted and the telephone becomes silent. The experiment is repeated, carrying the transmitter to T″, and again the telephone is silent.

It is easy to see how, by placing successively in all directions the exciter and detector, sufficient exactness may be established, with the aid of plans and calculations, regarding the existence and position of the mineral mass.

Naturally this work ought to be preceded and accompanied by a complete study of the geological formation of the hill, when the Hertzian method will give a preliminary indication of the existence and location of the mineral mass. The study should be continued and completed by the means described. For instance, between the outcrop and the side of the hill to which the lower extremity of the vein seems nearest, the electrical resistance method may be applied. Then between R and R″, assuming that there is a covering of earth over the deposit, the silent zone system can be applied. With this well-organized series of experiments are completed sections and plans more than sufficient to give an adequate judgment on how to attack the problem of exploiting the deposit.

Let us now take up a new case, that of the examination from the interior of a working mine and from the exterior to determine the presence of a mineral zone whose existence is suspected.

Fig. 3 explains the case, which is that of a zinc mine containing calamine mixed with lead carbonate (cerussite) and hydroxide (limonite).



This Diagram Illustrates the Method of Locating Mineral Zone When the Receiver is Underground in an Existing Mine and the Transmitter on the Surface.

To start with, the exciter is placed at the point T, and the detector in a drift at the bottom of the mine at the point R; the clear sound produced in the telephone shows that the line TR is clear of all mineral deposit. Leaving the detector at the point R, the exciter is carried down the hill to T′; the operator, listening below, still finds a rapid diminution of the sound, and soon perfect silence. This shows the presence, which we may assume has been suspected by other indications, of a new mineral zone; keeping the detector at R, the exciter is carried down the hill toward T″. At a certain moment the sound which was lost is again heard; it gradually becomes stronger, and finally is heard with full intensity, which indicates that on a given line, RT″, the rock again is completely sterile. At this point the operators trace a first profile of the terrain explored, and then apply other tests. The exciter is carried to T^4 at the end of the drift, and the detector is carried first to R′ and then to R″, then to T^1 and to T″; this gives four new lines. T^4R^1 shows the end of the deposit; T^4R'' controls and confirms the preceding; T^4T'' indicates the presence of the deposit higher up; T^1T^4 indicates the sterility of the rocks in this direction. Thus we are able to complete our profile acquiring an approximate section of the mineralized mass as discovered. The work is continued afterwards on other sections of the deposit so as to delineate with the greatest possible accuracy the points of contact with sterile rock surrounding it and its precise boundaries. The data thus obtained are controlled and completed by experiments on the other systems. A confirmatory test, which would be quite interesting, is that obtained by stretching a long wire on the left side of the hill, as shown in the drawing, making good earth contact on two outcrops, measuring the resistance of the intervening soil, and then taking one of the earth contacts out of the outcrop and carrying it away to a certain distance between T and T″. In the first case the circuit is closed through the two deposits, and the small zone of sterile ground between, while in the second case the circuit is closed through sterile soil, and the resistance increases. This shows that the distance between the nearest points of the two deposits is less than the distance from the outcrop to the point in which the second earth contact was made. This data is useful taken in connection with the Hertzian test.

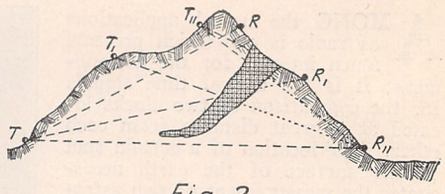


Fig. 2

To Locate Presence of Ore in a Hill the Positions of Transmitter and Receiver are Varied as Shown Above. If Ore Interposes Reception is Prevented. Records are Made of Results at Each Position.

Fig. 4 shows the third case of application of the Hertzian method; two shafts were excavated below a mass of manganese ore, and reached the point where the mass thinned out and disappeared. The question now is to know whether there was a break in the deposit or whether this was a definite end of the deposit, so as not to keep on pushing drifts without finding any more mineral.

The first investigation was carried on in the open with direct observation, and the result was negative over a large piece of territory to the right of the excavation. It was feared that owing to the depth of the new body searched for, and the low power of the

(*Continued on page* 541)

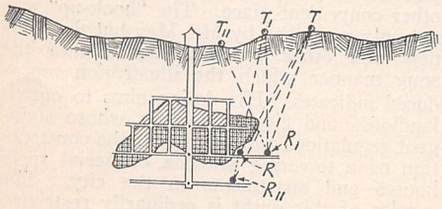
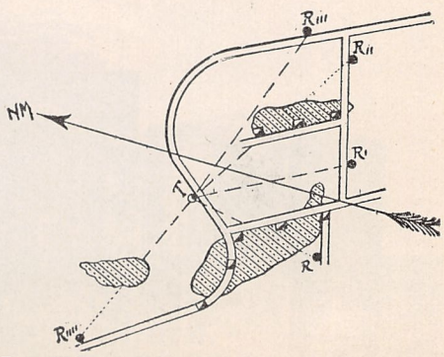


Fig. 4

The Ore in this Mine Played Out. It was Possible by Radio to Determine Whether There was Merely a Break or an End to the Deposit.

(Abstract from an article published in our Italian contemporary "l'Audion")



Tests Were Made in the Manner Shown Above to Determine the Location of a Mass of Ore Near an Existing Mine, the Presence of Which Seemed Probable.

Radio Used for First Time in Real Estate Deal

By JAMES MILLEN

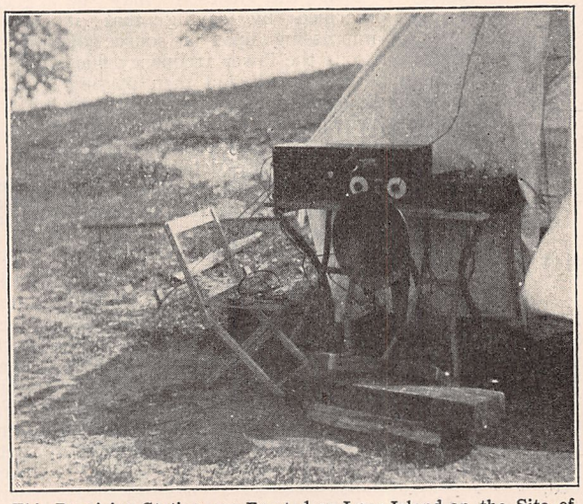
IS the every-day use of radio in the business world spreading? It certainly is. Who would have thought, even a few months ago, that radio would be indispensable in a large real estate auction? But this is now the case. Joseph P. Day, the real estate auctioneer, sold on July 8, and following days, 1,500 lots on Long Island. Here for the first time in history a complete radio station was erected and an operator employed in order to help make the auction more successful.

The station, which was erected by a Radio Service Company of New York City, consisted of a de Forest type MR6 Inter-panel set and a Western Electric power amplifier and loud speaker. The action of the loud speaking unit and power amplifier was most gratifying, as it did not distort even the loudest signals. The power amplifier was of the two-step type, employing three tubes, two being used in the second step, one working on each half of a split secondary transformer. This arrangement did much to eliminate distortion as well as to prevent the last tubes (a total of six being used in the entire outfit) from being over-loaded.

The aerial consisted of a single wire about 200′ long and 10′ high. A 5′ pipe was used for a ground.

As all messages for the station were sent on schedule, it was not necessary to erect a transmitter. This would have been rather difficult, owing to lack of power.

The purpose of the installation was to receive messages for Mr. Day and his assistants on the day of the sale, there being no telephone service. All telegrams and phone calls were sent to the writer's station, 2BYP, at Forest Hills, from where they were relayed on schedule to the Matawok radio receiving station, located on the property to be sold. On July 7 and 8, however, it was deemed advisable for the mesages to be sent by radiophone instead of the straight C.W. employed at 2BYP Station. 2BUM of Richmond Hill, therefore, forwarded all traffic over his phone set. This made it possible for everyone to hear any messages of general interest, as 2BUM's phone located but two miles away, made some racket when brought in on a six-tube set. Without this system it would have been necessary to have had an extensive messenger boy service, which even at its best could not have equalled the radio.



This Receiving Station was Erected on Long Island on the Site of a Property Sale. Messages from the City were Relayed.

The advertising advantages of such a radio station were not overlooked, and the advertising so received probably more than paid for the entire installation and operating costs. The station was located but 30′ from the main line of Long Island railroad. Here the railroad passengers could not help but see and hear the radio installation. In fact it was quite interesting to note the crowds on the passing trains stretching their necks in order to see where the mysterious music was coming from. Thus many people came to the auction who would otherwise not have known of its existence.

A bulletin board was kept, upon which baseball scores, and other items of general interest were posted in large letters for the benefit of the railroad passengers.

And now a word as to the results obtained with the receiving apparatus. WJZ, WWZ, WHN, 2XB and 2BUM were plainly heard at distances in excess of 1,500 feet from the loud speaker while WNY and several of the other 600-meter commercial stations could be heard for over one-half mile. All the other broadcasting stations of New York City and vicinity were received but with less volume. All receiving was done during the day time.

A system of announcing the messages of general interest as received from either 2BYP or 2BUM was arranged. This system worked most satisfactorily and the voice of the announcer could be plainly heard for a considerable distance, even above the noise of the auctioneer and the people.

The novel idea of using radio for this purpose was originated by Mr. Richard G. Conover, Publicity Manager for the Matawok Land Company, owners of the property to be auctioned.

Curious Calls of the Ether

KOP Brings Police and WET, a Shipping Board Vessel

ASSIGNING radio calls is something of a trick and, with the constant increase of stations, it is in the way of becoming an art. In this country we have but three initial letter calls for about 5,000 official and commercial stations, which makes the designation of appropriate calls almost impossible. Having only the letters N, K and W to start a word with, even champion word makers who spell thousands of words out of trade names, would be stumped in the position of Chief Radio Inspector of the Department of Commerce.

In some instances he has done pretty well. All calls starting with N are Naval, which is very appropriate, and the Army calls commence with W, which is somewhat significant as referring to the War Department. The rest of the W calls, he heedlessly assigned to the Eastern part of the United States, leaving K for the west coast. The definite geographical call WVA (W. VA.) went to a city in Alaska; while to a Naval station at Savannah, Ga., he gave the letters, NEV (NEV.), which would have suited a station in Carson City far better.

When the inspector got down to specific stations, however, he did far better; what could be more suitable than the call assigned to the Detroit Police Department, KOP—unmistakable! In view of the recent revelations by Adolphus Busch, some of the Shipping Board's calls are quite appropriate. The craft known as the West Gotomska carries the significant call WET, while the Rio Grande answers to the call of KEG; the Chamblee has the same signal but spells it KEGG, while the West Hartland makes it plural, KEGS. Speaking liquor-ishly, Great Britain got a gem of a call in the anti-prohibition signal, GIN; and also, since she has V with several other letters, uses the call VOP—significant of a very fine brand in the old days. Russia, with the letter R, of course has RUM and RYE ships. Another vessel of the Shipping Board has a startling title when it comes to radio prefixes—KORK, which some experts insist belongs to Ireland—but that one has already been pulled.

The chief call assigner of Great Britain, with the letters B and G and Y, had a lot more chance to display his versatility in issuing signals. Among unusual British calls are BVD, GOP, YAP; more suitable for America, it would seem.

The station made famous by Radio Ralf has been identified as the U. S. Destroyer Parker, bearing the call NIX. The Navy got a few negative calls, including NIT, NOT and NAY. YES falls to Great Britain, but OUI happens to be Danish instead of French, showing that other radio inspectors go wrong.

One Southern Pacific passenger ship bears the title of a famous southern fraternity, KKK, and an Italian contemporary goes it one better with the well-known call, IWW. Japan got one appropriate signal and one which is far from suitable; the first is the station JAP, and the other is labeled JEW. A French radio station carries the designation FUN and a British sub, the Polly-Anna, the title GLAD. Another English sub bears the name of GABY, formerly of France. FAN aptly denotes one French operator, and an unfortunate Madagascan station got FLU.

Some American naval vessels have calls which spell the names of their sweethearts, NAN and NEL, while another ship has the sentimental call KISS. Radio broadcasters have a perfect right to kick when assigned such calls as WEAK and WEEP, yet two suffer under those titles despite good service, showing the failings of the Radio Inspector who made another mistake when he gave the significant call WEAR to a newspaper instead of to John Wanamaker, Gimbel Brothers or Strawbridge & Clothier, whose calls fail to identify their businesses.

COLUMBUS THEATER TO HAVE RADIO

A decided innovation in the theatrical world has been inaugurated by the Hartman Theater of Columbus, O., which is installing a radio-receiving plant with specially designed sound amplifiers to replace the traditional orchestra during the summer season when the theater is devoted to "stock" productions. A minor set, which has been already installed, gave such satisfaction that the management of the theater decided to go into the project on a larger scale, dispensing with the orchestra in summer. Heretofore the set has been supplementary to the regular orchestra.

In place of the overture and entre-act selections of the orchestra, the station will be turned in to receive such concerts as are being broadcasted. Due to the wide variety of

(*Continued on page* 561)

A Method of Amplifying Electrical Variations of Low Frequency*

By W. H. ECCLES and F. W. JORDAN

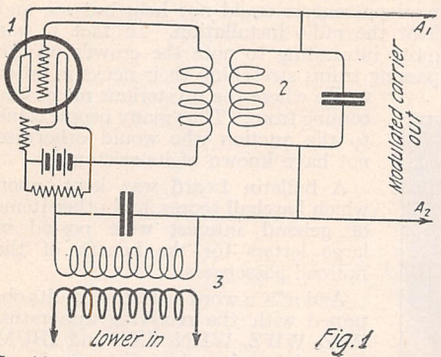


Fig. 1

In this Circuit the Speech Currents are Imposed on the Plate Circuit of a Self Oscillator.

IT is well known that the amplifiers used for amplifying the high frequency oscillations received in wireless telegraphy are sometimes incapable of passing oscillations of much lower frequency, such as those of audible frequency, and in fact are sometimes purposely designed so as to refuse passage to current of audio frequency. The method to be described, however, enables one to utilize a high frequency amplifier for the amplification of speech currents. In general the method can be used for certain ranges of frequency with any amplifier. For example an amplifier designed for direct use with oscillations of frequency 300,000 per second may be used for amplifying fluctuations of, say 30,000 per second, or 3,000 per second or 3 per second; while an amplifier built for magnifying oscillations of frequency 1,000 per second may by aid of this method be used to amplify fluctuations of, say 50 per second or lower. In order to assist in explaining the method let the frequency of the oscillations for which the amplifier is designed be called the "carrier frequency" and the frequency of the oscillations or fluctuations to be amplified the "lower frequency"; then the method may be compactly described by saying that it consists of impressing upon a source of carrier oscillations the lower frequency fluctuations to be magnified, and then passing the modulated carrier oscillations through the amplifier, which magnifies them as modulated. The lower frequency oscillations are then rectified or otherwise detected in the magnified currents and voltages. Details of some convenient ways of performing these processes are given below.

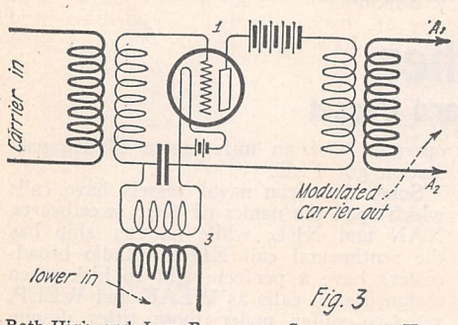


Fig. 3

Both High and Low Frequency Currents are Here Impressed Upon the Grid Circuit.

One merit of this method especially when the amplifier is designed to pass only a particular frequency is that resonance at the carrier frequency may be utilized to increase the magnification; and an advantage over triode amplifiers designed solely for audible frequencies is that valve noises and sustained singing troubles can be reduced. Obviously the amplifier may be of the transformer or resistance cascade type passing and magnifying a variety of carrier frequencies, or it may be especially designed to magnify only one frequency; or a combination might be made of a high frequency amplifier with a frequency sifting device.

The source of oscillations is most conveniently an ordinary triode oscillator, but it may be any other type of oscillation generator. The lower frequency electrical fluctuations may be impressed on the carrier oscillations by any of the means used for the same purpose in radio telephony. It is well known that in radio telephony the vibrations of speech frequency are impressed on radio oscillations which are then utilized in producing free electric waves for transmission to a distance. In the method here proposed, however, the carrier oscillations are not used for creating electric waves, but are used only for passing the fluctuations through the amplifier.

As illustrations of the method we shall now describe some experiments we have made on the magnification of speech currents by aid of the French military amplifier using a carrier wave-length of about 3,000 metres.

Fig. 1 shows a circuit in which the three-electrode tube 1 generates radio oscillations in the closed oscillatory circuit 2, the voltage applied to the anode being tapped off the filament battery. Speech currents are imposed on the anode circuit by means of the transformer 3 and the modulated radio oscillations are led from terminals A1, A2 to the radio amplifier.

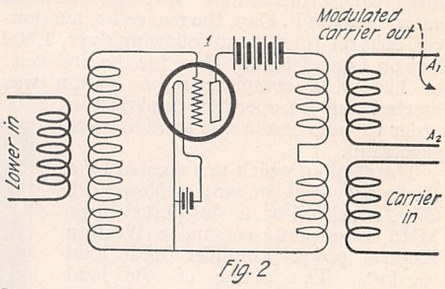


Fig. 2

In this Circuit the Low Frequency Fluctuations are Impressed Upon the Grid Circuit While External Source of High Frequency is Impressed Upon Plate Circuit.

Fig. 2 shows a circuit in which carrier oscillations from an independent source are imposed on the anode circuit of a three-electrode tube while the lower frequency fluctuations are imposed on the grid circuit. The modulated carrier oscillations are taken from the anode circuit to the radio amplifier.

Fig. 3 shows a circuit in which both the carrier oscillations and the microphone currents are imposed upon the grid circuit of a three-electrode tube, the modulated carrier oscillations being taken from the anode circuit to the amplifier.

Fig. 4 shows a circuit in which the carrier oscillations are imposed on the anode circuit and the audio vibrations on the grid; the modulated oscillations are taken from the anode circuit to the amplifier.

For the purposes of separating or detecting the lower frequency in the amplified modulated currents and voltages, any of the methods familiar in the practice of radio-telephony may be used. For example, the amplified modulated currents may be passed to a crystal detector or to a diode or triode arranged for rectifying and the rectified

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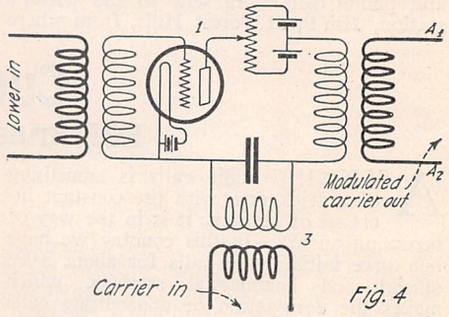


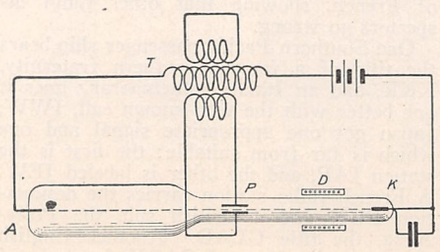
Fig. 4

The High Frequency Oscillations are Here Impressed Upon the Plate and the Low Frequency Upon the Grid Circuit.

*Abstracted from The Electrician.

A New Vacuum Tube

IT is well known that the cathodic rays produced in a vacuum tube are constituted by a flow of negative electrons which consequently are sensitive to the action of an electric field. Through this principle Mr. Nasirichwily has produced a means of generating electric oscillations of very high frequency. The sketch shows the circuit used. A Braun tube having a cathode, K, heated, and an anode, A, mounted at the other end of the tube, usually occupied by the luminous screen, is connected to a coil, D, through which flows of little current which helps in centering the flow of elec trons upon the anode, A. The negative pole of a D. C. source, the voltage of which may be varied from 1,800 to 3,500 volts, is connected to the cathode, while the positive pole is connected to the anode through the primary of the transformer, T. The secondary of this transformer is connected to the circuit into which it is desired to produce the oscillations and an auxillary circuit is connected to the plate, P, of a condenser mounted inside of the tube.



A New Type of Vacuum Tube Which Produces Oscillations. The Method is Shown in the Text.

When the cathode is heated, a current of .09 to .97 milliamperes flows through the tube, but at the same time the induced current charges the condenser, P, and the electrostatic field deviates the flow of electrons which, consequently, do not fall any more upon the anode, A. The current is then stopped in the circuit and the electro-static action of the condenser, P, stops. The flow of electrons being free from influence, is again projected upon the anode and the same phenomenon is produced indefinitely.

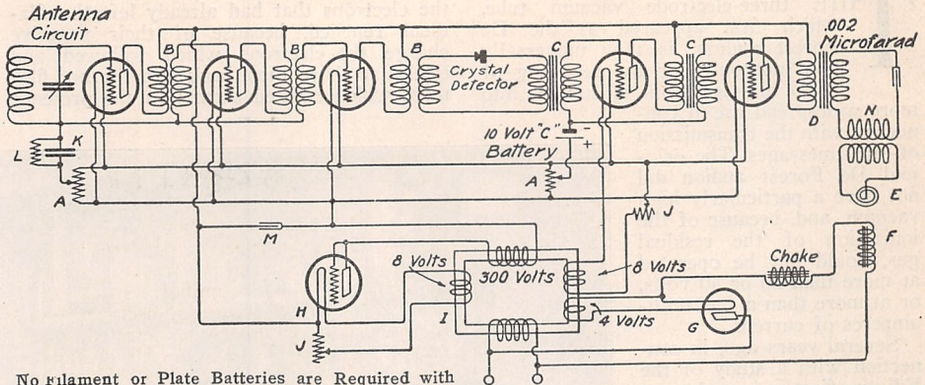
Discarding Storage Batteries

By S. R. WINTERS

THE unwieldy storage battery, heretofore considered an integral part of radiotelephone receiving apparatus, may be discarded in the future and another source of electric current tapped effectively. An electron-tube amplifier, employing a 60-cycle alternating current in supplying impulses to both filaments and plates of the vacuum tubes, has been designed by P. D. Lowell of the Radio Communication Section of the Bureau of Standards, United States Department of Commerce. Elimination of storage batteries is possible by forming contact with a common electric-lamp socket.

The newly-designed amplifier, in the absence of which the use of storage batteries is not obviated, is provided with three stages of radio-frequency and two of audio-frequency. A crystal detector is used in this system instead of an electron-tube detector. Amplification derived from the use of an alternating electric current is quite as effective as when direct current is employed. The complete outfit for the reception of radio-telephone communications is compactly built and may be readily transported from one place to another. The experimental unit, as originally designed by the Radio-Communication Section of the Bureau of Standards, operates effectively when adjusted to wave-lengths ranging from 200 to 750 meters. These wave-length restrictions can be removed or expanded by the application of suitable radio-frequency transformers. The new amplifier may be used with any type of antenna.

The distracting hum or the din of noise from alternating electric current when substituting for storage batteries in previous experimental efforts to discard the latter has been the bane of all such attempts. The system evolved by the Bureau of Standards, if we are to accept the usual conservative claims of this government department, has been reduced to a minimum. The humming noise in the final analysis is not distracting. To accomplish this end, wireless amateurs who may attempt to duplicate the amplifier conceived by this government bureau, will find it necessary to manipulate a larger number of adjustments than when employing a conventional amplifier, whose source of strength is the storage battery.



No Filament or Plate Batteries are Required with this Circuit. Power Is Supplied by the A. C. Light Line and Rectified. A Magnavox Field is also Supplied from the Same Source

A 60-cycle alternating current when applied to the service of an ordinary amplifying circuit introduces such a robust note in the telephone receivers as to render reception impossible. This condition, in the system being described, is well-nigh obviated by an arrangement involving the use of balancing resistances, grid condensers, and special grid-leaks of relatively low resistance, telephone transformer in the output circuit, and the employment of a crystal detector instead of a vacuum tube in this capacity.

The newly-conceived electron-tube amplifier, instead of employing a storage battery for lighting the filament and a dry battery as a source of strength for the plate circuit, substitutes therefor a special transformer and an electron-tube rectifier, as well as other accessories. The bulk and weight of these combined units are less than that of storage batteries. A small 10-volt dry battery is used in the grid circuit, the obligation imposed on this source of electricity being only to deliver an infinitesimally small current. The life of this battery is reasonably assured for several months. The parts utilized in this electron-tube amplifier in replacement of the storage battery may be obtained at a moderate cost. The specially-designed transformer is the only unit that approaches in financial investment that involved in obtaining a storage battery. The labor of assembling is the outstanding consideration in acquiring this transformer.

Bulkiness, its weight in pounds, the necessity of charging periodically, and the acid

(*Continued on page* 562)

Practical C. W. Design Data

By CHARLES DAVISON

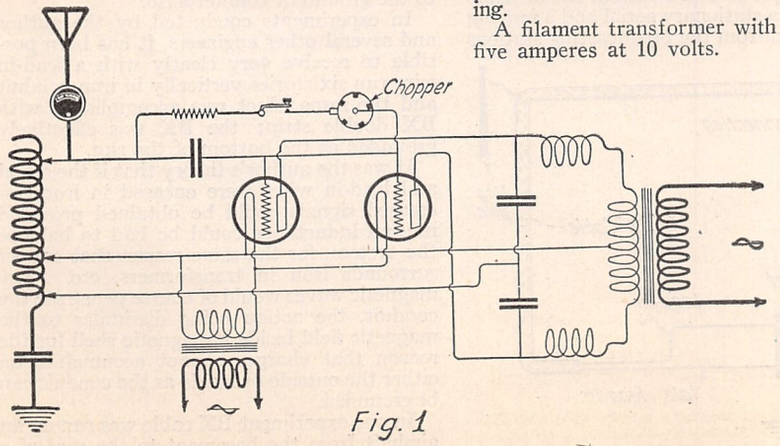
NOW that standard power tubes are available for amateur use it is probable that considerable experimental work will be done in building tube transmitters. The writer of this article has had a number of years' experience in the design and operation of continuous-wave equipment and it is hoped that this discussion will provide some practical information for the amateur who is about to build his first C.W. set.

We shall first consider a circuit that is to be used solely for straight C.W. and I.C.W. (interrupted continuous wave) transmission. Obviously any circuit that eliminates the expensive motor generator or rectifier tubes will quickly find favor. A properly built self-rectifying transmitter has these advantages and at the same time will give as great or greater range than more complicated systems.

Working on the basis that two of the five-watt power tubes are to be used as oscillators, the following units are required:

A 50-watt transformer giving a secondary voltage of 700 to 800 with a tap brought out at the midpoint of the secondary winding.

A filament transformer with an output of five amperes at 10 volts.



The proper circuit to use in a self-rectifying C W. and I.C.W. transmitter. Values of the constants are given in the text.

Fig. 1

Two radio chokes for the plate circuit.
Two by-pass condensers.
A chopper or grid circuit interrupter.
An oscillation transformer.
An antenna series condenser.
A grid leak and grid condenser.

These units are connected as shown in Fig. 1.

The plate and filament transformers may be purchased as one unit. Each radio choke consists of 150 turns of No. 24 D.C.C. wire wound on a core 2½" outside diameter. The by-pass condensers should each have a capacity of .001 mfd. and be insulated for 500 volts.

A single coil oscillation transformer will be found to give good results in this circuit as we need not worry about decrement with a C.W. set. This coil consists of 30 turns of No. 6 bare copper wire, the turns being spaced ½" apart with an outside diameter of 8".

The antenna series condenser may be variable from .0003 to .0008 mfd. If the antenna fundamental is low enough this condenser is not required. For the grid condenser we may use a capacity ranging between .002 and .004 with insulation to withstand 300 volts. The grid leak should be about 5,000 or 6,000 ohms resistance, with a carrying capacity of 30 milliamperes.

After the various units have been connected as shown in Fig. 1, the transmitter is ready to be adjusted for maximum output

(*Continued on page* 539)

The 20 K.W. Power Tube

By DR. IRVING LANGMUIR*

THE three-electrode vacuum tube, which first appeared as the De Forest audion, is now universally used not only for the receiving of radio messages, but is coming into more widespread use in connection with the transmission of such messages. The original De Forest audion did not have a particularly high vacuum, and, because of the ionization of the residual gas, could not be operated at more than 30 or 40 volts, or at more than a few milliamperes of current.

Several years ago, in connection with a study of the Edison effect in incandescent lamps, I noted that, in lamps with a very good vacuum, the Edison effect was nearly absent. In other words, although there was a difference of 11 volts between the two ends of the filament, very little electron current flowed across the vacuum space between. In the presence of a little gas, however, such big currents were obtained that the currents might lead to the formation of an arc, with resulting destruction of the lamp.

At that time it was not at all understood why these currents should become smaller as the vacuum was improved, and a great many scientists believed that if a perfect vacuum could be made no current at all would flow across it. Although the Edison effect in well made lamps thus caused no difficulty in their manufacture, for it practically did not exist, yet it was a point of very great scientific interest to learn why these currents were so small in a good vacuum.

Dr. Langmuir Holding the New 20 K.W. Power Tube He Perfected and a Small Receiving Tube by Way of Comparison.

It was in connection with these studies that we discovered a "space charge effect." We then understood that in a high vacuum the electrons got in each other's way, so that the electrons that had already left the filament repelled, because of their negative charge, the electrons which followed and tended to drive them back into the hot filament which emitted them. In the presence of gas this effect did not exist, because the gas formed both positive and negative ions, and the accumulation of the slowly moving positive ions in the space neutralized the effect of the negative electrons.

As the result of these studies it gradually became clear how it would be possible to construct vacuum tubes which would operate at high voltages and at high currents. One of the early applications of this new knowledge was made by Dr. W. D. Coolidge, who utilized this in the development of the Coolidge X-ray tube, an X-ray tube which has gradually displaced practically all of the older, so-called gas tubes.

Another application was found in the kenotron and pliotron. The kenotron is a vacuum tube rectifier, having two electrodes like the Fleming valve but capable of operating up to voltages of several thousand volts and with currents comparable with an ampere or more. Tubes of this kind have found application for smoke precipitation, for various electrical testing devices, and in connection with the regulation of the electric generators used for the radio transmitting outfits on aeroplanes during the war. The development of the kenotron into a thoroughly practical device for these purposes is largely the result of the work of Dr. Saul Dushman.

The pliotron bears about the same relation to the De Forest audion that the kenotron does to the Fleming valve. It is a device which contains three electrodes, namely, a filament, grid, and plate, like the audion, but it is capable of being operated at high voltages and currents, so that considerable amounts of power may be controlled. Tubes of this sort are now finding widespread application for transmitting radio messages, particularly for radio telephony. The ordinary radio

(Continued on page 510)

*Research Laboratory, General Electric Co.

Iron Conduit for Lead in Wires

By LEO S. LOOMIS

A POPULAR idea, prevailing at present is that the lead-in wire must not be run in conduit. However, it is only necessary to consider the problem from the mutual inductance standpoint for a satisfactory solution.

As is well known, any single wire should not be run in conduit due to the phenomena of self inductance, or the interlinkage of the flux which surrounds any alternating current conductor, with the conduit.

The iron acts as a fertile field and the interlinkages multiply to such an extent that the counter E.M. F. of self induction opposes the passage of current.

However, in any balanced single or multiphase system, the return-current balances the in-current and the field surrounding the wires is zero.

Hence, if in a lead-in wire conduit we introduce a second wire carrying a current of the same frequency, but differing in phase, the system is balanced.

In the aerial we have a change from magnetic to dynamic energy. That is, just as in a generator when a copper conductor is moved against a magnetic field a current can be made to flow, so in a stationary aerial and a moving magnetic field from the broadcasting stations a dynamic current flows in the lead-in wire to the ground or counterpoise.

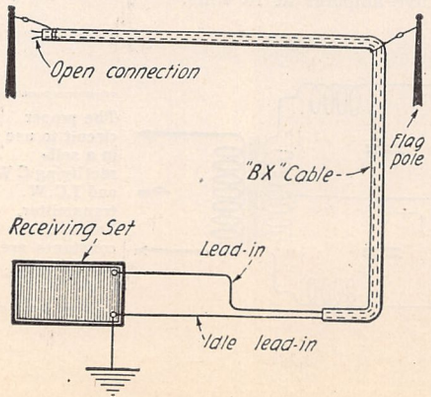


Diagram of the Aerial Used by the Author During His Experiments.

In experiments conducted by the author and several other engineers, it has been possible to receive very clearly with a lead-in wire run six stories vertically in iron conduit and the same effect was accomplished with BX double strip; the BX was effectively grounded at the bottom of the run.

It was the author's theory that if the aerial and lead-in wires were encased in iron, increased signals could be obtained provided mutual inductance could be had to balance the system, for the same reason that copper surrounds iron in transformers, etc. The magnetic waves would of course penetrate the conduit, the action being dissimilar to the magnetic field inside a magnetic shell for the reason that charges cannot accumulate on either the outside or inside as the conduit can be grounded.

In one experiment BX cable was run up an airshaft from the basement to the roof of a six-story building and up a flagpole for approximately 20′ and brought down, umbrella-

(Continued on page 580)

Home-Made Moulded Variometer

By T. L. STALKER

FOLLOWING is a method of making a variometer that gives a more substantial article than those in which the winding is fastened into the stator with shellac or glue.

I will not describe the making of the rotor or the winding form for the stator, as the experimenter will have to purchase these if he has no lathe; if he has one, he has probably made them before this. I would say, however, that the winding form should be as smooth as possible.

Two frames (see Fig. 3) are made from thin wood. (This may be obtained from old cigar boxes.) They should be about ½" larger on the inside than the largest outside diameter of the winding form and as wide as the winding space on the rotor. The blocks in the corner are not necessary, but will help to stiffen the frame and will also save wax. A ½" hole is drilled in the bottom of each frame and a binding post also may be mounted on the top if desired.

The next step is to make the covers for these frames, four of which will be required, two outside and two inside. The inside covers should each be the thickness of one-half the ridge in the center of the rotor that is to be used. The hole should be just large enough for the winding form to pass through. These holes may be cut in the thin wood with a sharp pair of dividers, if care is taken not to use too much pressure in starting. After the holes have been made it is a good plan to tack the two inside covers together with a couple of small brads, being careful that the holes line up, and dress the outside to the same size as the stator frames. After having completed these two pieces they should be fastened to the stator frames with small brads.

The outside covers should be made in the same way except that the hole is of such size that the small end of the winding form will just enter it, as shown in Fig. 2. These pieces should be slightly larger than the stator frame so that they may be dressed down after the stator is assembled.

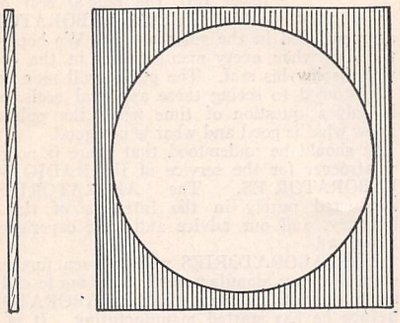


Fig. 4

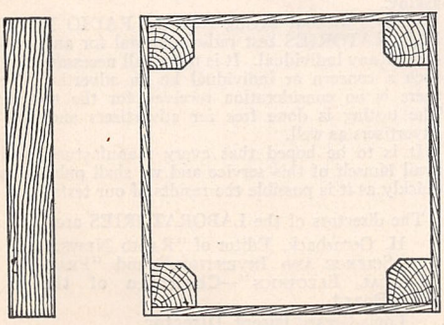


Fig. 3

To Make This Variometer Wooden Frames, as Shown Above, Must First be Constructed. Two Frames Shown in Fig. 3 Are Required, and Four Covers Indicated in Fig. 4 Are Necessary. These Frames and Covers Are Assembled as in Fig. 1.

One of these outside covers is now slipped over the winding form and a block screwed to the form to hold it in place. At the point where the winding starts, a small brad with the head removed is driven through the cover into the block, as shown in the sketch. This keeps the cover from turning and also holds the end of the wire which is bent around it. Using the stator frame as a gauge, a pencil mark is drawn around the winding form the same distance from the outside cover as the width of the frame. Winding should be stopped at this line and the last turn fastened with a heavy thread through the hole, as shown in sketch. I have used cotton-covered wire and enameled wire in making these variometers, and have found that both work very satisfactorily.

After the winding has been completed the assembly of form, winding and cover are placed in the stator frame, the unwound portion of the form entering the hole in the inner cover and the ends of the wire being carried out through holes in the frame or soldered to binding posts. The outside cover is then nailed to the frame with small brads in the same manner as the inside cover was fastened.

Wax is poured around the winding to hold it in place. This wax may be obtained from the tops of old dry cells or may be purchased from a battery shop. It must be hard enough so it will not soften in the warmest weather. The writer has used a mixture of rosin and beeswax to very good advantage. In pouring the wax into the form it is a good plan to tilt the latter so that the wax will flow down one side of the windings and the air escape on the other side, otherwise air bubbles may appear and prevent the form from filling properly. It is necessary to add wax while the job is cooling or there will be a hole around the top of the form caused by shrinkage.

After the form has cooled (five or six hours) the block that was screwed to the small end of the winding form is removed, also the brad that held the winding. Rapping sharply on the small end of the winding form will loosen it so it may be removed; this leaves one-half of the stator complete, and the other half is made in the same way.

The two halves are now clamped together, care being used to see that they match on the inside, and fastened at each corner with a long wood screw or machine screw and nut. When this is done the outside of the stator should be trued up and all corners rounded slightly. (I use a flat block with half a sheet of sandpaper glued on it for this purpose.) It should then be finished with black enamel or stained and varnished.

After the stator is finished the two halves are separated and the hole for the rotor shaft is gouged half from each piece. If the connections are to be pigtailed to the shaft, this hole may be made a good fit for the shaft and act as a bearing for same; but if brass plates are used for bearings, the holes in the wood should be made larger than the shaft for clearance.

To complete the variometer all that is necessary is to assemble the two halves of the stator with the rotor in place and make the usual connections.

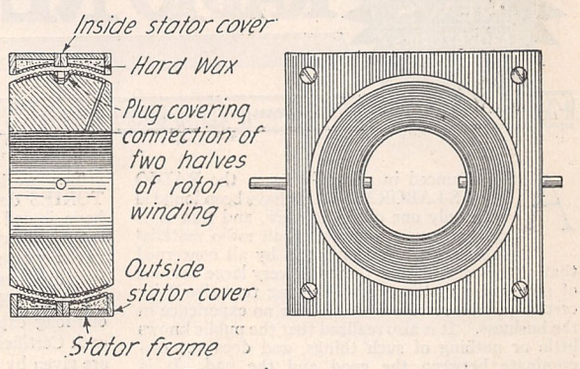


Fig. 1

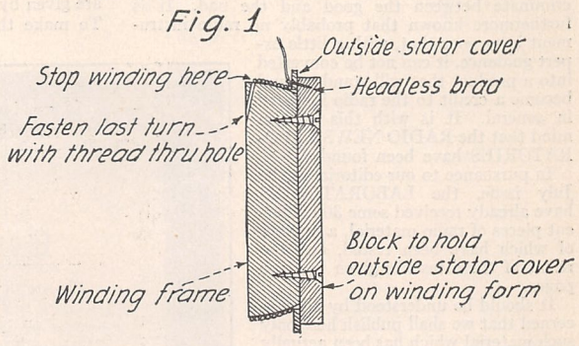


Fig. 2

The Method of Winding and Assembling the Variometer described in the Text is Illustrated Above.

HOW TO MAKE A NAVY KNOB FOR YOUR KEY

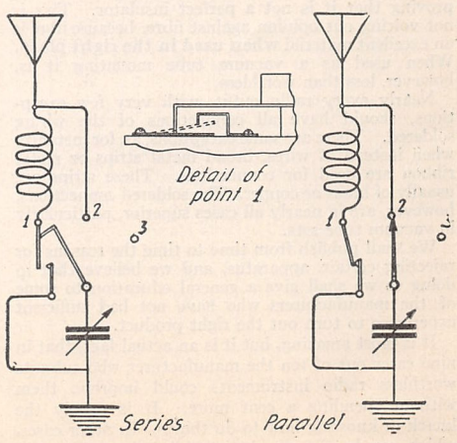
If you want to make a navy knob for your key take a piece of victrola record or other hard rubber. Cut it into a circle 1½-inch diameter and drill a hole in the center. Screw the knob off your key and put the shank through the hole, screw the knob on again. The result is a key knob which rests the fingers.

Contributed by CHARLES HAM

SERIES PARALLEL CONDENSER SWITCH

This series parallel switch, besides taking less material than the ordinary switch, requires less space. It consists of an ordinary single blade, three-point switch. Two points are of the usual kind, and the other has a circuit opening arrangement. When the blade is on point 1, the condenser is in series with the inductance; when on point 2, it is in parallel; on point 3, it is out of the circuit.

Contributed by F. ANDERSON.



A Novel Type of Series Parallel Switch Which Can be Easily Constructed.

AS announced in our July issue, the RADIO NEWS LABORATORIES have been founded with only one object in view, and that is to give an expert opinion on all radio material submitted. It is realized by all concerned that at the present time there is a very large amount of poor radio material that is being turned out by certain manufacturers with little or no experience in the business. It is also realized that the public knows little or nothing of such things, and does not discriminate between the good and the bad. It is furthermore known that probably no radio instrument is so poor that, with a little expert guidance, it can not be converted into a product that will stand up and become a credit to the radio industry in general. It is with this idea in mind that the RADIO NEWS LABORATORIES have been founded.

In pursuance to our editorial in the July issue, the LABORATORIES have already received some 300 different pieces of radio material, a number of which have been tested, and the result of these tests is given in these pages.

It should be understood by all concerned that we shall publish here only such material which has been actually tested by the engineers of the RADIO NEWS LABORATORIES. These tests are very strict and embody the most advanced ideas in radio engineering. If certain elemental rules are not complied with by the parties submitting material, the article will be rejected. In that case a letter of advice will be written to the manufacturer, informing him of the defects of the instrument or apparatus and advising him how the deficiencies can be overcome. The manufacturer is then invited to re-submit the instrument or apparatus, when finally improved. If the suggestions have not been complied with and the proper corrections made, the article will, of course, be rejected again.

There are certain fundamental points on a radio outfit which can not be disregarded by a radio manufacturer. Just to mention a few: When the manufacturer of a vacuum tube set sends in a model that has a coil wound on a plain, bare cardboard tube which has not been treated, and upon which the wire is loose, the apparatus will be rejected, even though it should work. The idea is that an instrument of this kind will in time positively become defective or cease working. If a manufacturer persists in using a fibre board upon which to mount and wire a vacuum tube set, such an outfit can not pass the LABORATORIES, for the simple reason that fibre is not a good insulator, but almost a conductor. If any one doubts this statement, all he needs to do is to mount two binding posts ½ of an inch apart on a piece of fibre and put a telephone receiver and a few batteries in series. He will get an audible "click" through the fibre, proving that it is not a perfect insulator. This is not voicing our opinion against fibre, because fibre is an excellent material **when used in the right place.** When used as a vacuum tube mounting it is, however, less than worthless.

Nearly every radio outfit, with very few exceptions, should have all connections of the wiring soldered. There are some exceptions, as, for instance, when instead of wires, broad metal strips or metal ribbon are used for connections. These strips are usually of brass or copper. The soldered connections, however, are in nearly all cases superior, particularly in vacuum tube sets.

We shall publish from time to time the reasons for rejecting certain apparatus, and we believe that in doing so we shall give a general education to some of the manufacturers who have not had sufficient experience to turn out the right product.

It is most amazing, but it is an actual fact, that in nine cases out of ten the manufacturer who submits worthless radio instruments could improve them without spending a cent more. It is simply the knack of knowing how to do things. In other cases, which we have seen, by spending less than 3% additional, the instrument could be improved 100%.

The work of the RADIO NEWS LABORATORIES does not stop here. Let us say that we have issued a CERTIFICATE OF MERIT to a manufacturer. **This means only that the apparatus works, and is well made from an engineering standpoint.** IT DOES NOT MEAN AT ALL THAT IT WILL SELL, and this is where our long experience will come in. On the back of each Certificate there is a space left where suggestions are given by the Directors of the LABORATORIES. To make this clear, a certain manufacturer whose

1922 RADIO NEWS LABORATORIES Number ~1~

Certificate of Merit

We hereby Certify that this Certificate of Merit has been awarded to ~Lowenstein Radiophone Corporation~ in connection with their Variable Condensers LA.LB

This instrument has been subjected to the various rigid tests of our laboratories and has been found to possess all the high standards adopted for this type of Condenser.

The article complies fully with all modern radio engineering principles of this class.

Awarded the Certificate of Merit.

RADIO NEWS LABORATORIES

Director Technical Director Laboratory Director Chairman Directors

THIS CERTIFICATE OR SEAL IS NOT TO BE USED IN CONNECTION WITH ADVERTISING MATTER

Fac Simile of the Certificate and Seal of the Laboratories.

instrument is discussed in these pages submitted an excellent piece of apparatus. It worked exceedingly well, and the Certificate of Merit was issued. The tragic part about this, however, is that the instrument very likely would not sell. By skimping, **this manufacturer had neglected the all important appearance of the instrument entirely.** He neglected to nickel-plate certain parts and to provide a certain finish that is absolutely necessary and without which no dealer would care to put the instrument in a show case, or on the shelf. The suggestions for this correction were given on the back of the Certificate, and it is hoped that the manufacturer in question will see the point and will improve the appearance of the instrument in such a way that it will become a credit to any store, which now it is NOT.

This is the sort of service that the RADIO NEWS LABORATORIES have set out to give, and will give in the future.

We publish herewith the rules that are printed on the back of the Certificate, which will be enforced very strictly, and which are apparent, as well as self-evident.

CONDITIONS UNDER WHICH CERTIFICATE IS ISSUED

The article described on the reverse side, tested by RADIO NEWS LABORATORIES was submitted by the manufacturer or individual whose name appears on the front of this Certificate. In consideration of the issuance of this Certificate, the holder agrees to the following rules of the LABORATORIES.

1st. This Certificate covers the article as tested by the LABORATORIES. If any vital subsequent change is made on the article by the holder of this Certificate, the RADIO NEWS LABORATORIES must be informed of the change at once, and a new model or type must be submitted for test.

2d. If the Directors of the LABORATORIES secure in the open market duplicate article to the one tested and described in this Certificate, and if such article is found to be inferior to the one tested by the LABORATORIES in good faith, then this Certificate shall become null and void at once and will be publicly revoked by publishing a full notice of the facts in RADIO NEWS.

3d. This Certificate only covers the article as tested by the LABORATORIES. It does not cover a group of articles, unless this is stated on the face of the Certificate. If the article is changed to a very great degree subsequently, a new model is to be submitted. If the article possesses the former merit, a new Certificate will then be awarded, the original Certificate being cancelled automatically thereby.

4th. Holders of this Certificate are entitled to display in their advertisements in any and all publications of their choice, the approval seal of RADIO NEWS LABORATORIES. This seal may be printed alongside the illustration of the instrument or the article in question. If no illustration is used the seal may be displayed, in or alongside the text matter if desired.

5th. The holder of this Certificate agrees to abide by these rules. If he does not elect to do so, the Certificate may be returned to the RADIO NEWS LABORATORIES for cancellation, at the option of the holder.

SUGGESTIONS FOR IMPROVEMENTS

In addition to all of this, the LABORATORIES allow every manufacturer and advertiser to publish alongside of their apparatus or advertising text the official seal of the RADIO NEWS LABORATORIES, as mentioned in the rules above. We hope to see the day when every manufacturer in the country will display his seal. The public will soon become accustomed to seeing these approval seals, and it is only a question of time when the public will know what is good and what is not good.

It should be understood that there is no charge whatsoever for the service of the RADIO NEWS LABORATORIES. The LABORATORIES are conducted purely in the interests of the radio industry, and our advice and long experience are free to all.

The LABORATORIES will go even further and state that any manufacturer is welcome to call upon us or submit his plans to the LABORATORIES **before** he has started manufacturing. It is often possible to advise him and save him thousands of dollars before he starts. Sometimes a little change may make all the difference in the world, and may spell either success or ruin. All this experience which our engineers and directors have is free for the asking.

It goes without saying that the RADIO NEWS LABORATORIES test radio material for any concern or any individual. It is not at all necessary that such a concern or individual be an advertiser, for there is no consideration received for the testing. The testing is done free for advertisers and non-advertisers as well.

It is to be hoped that every manufacturer will avail himself of this service and we shall publish as quickly as it is possible the results of our tests.

The directors of the LABORATORIES are:

H. Gernsback, Editor of "RADIO NEWS," "SCIENCE AND INVENTION," and "PRACTICAL ELECTRICS"—**Chairman of the Board.**

Louis Gerard Pacent, **Director.**

Lewis Mason Clement, **Technical Director.**

Robert E. Lacault, Associate Editor of "RADIO NEWS"—**Laboratory Director.**

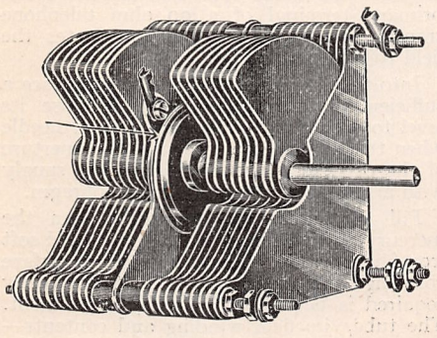
It should be noted particularly that Messrs. Pacent and Clement are not at all connected, in any way, whatsoever, with the Experimenter Publishing

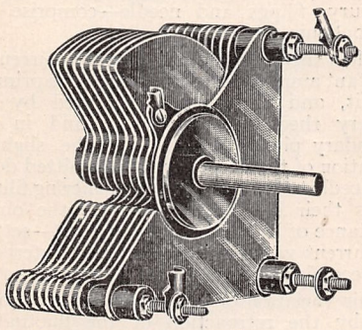
(*Continued on page 573*)

Apparatus Awarded Certificates

THE LOWENSTEIN VARIABLE CONDENSERS

These variable condensers manufactured by the Lowenstein Radiophone Corporation, 397 Bridge Street, Brooklyn, New York, are made in two sizes having respectively 19 and 38 plates and a capacity of .0005 and .001 M. F.; they embody features giving to the rotor rigidity, low dielectric losses and perfect contact to the movable plates. Only one



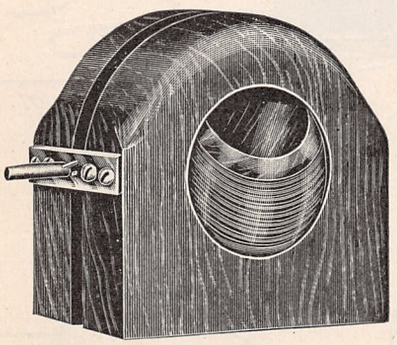


bearing is used but is of such a type that the plates are equally spaced. The bearing surface on the rotor is a flange instead of a shank so that this large flange surface is always in alignment with the flat support plate. This plate supporting the bearing is used as an end plate for condensers of small capacity and as the center plate for those of large capacity; in the latter case, the same number of plates are mounted on each side of the bearing as shown in the illustration. A stop pin is mounted inside the bearing, as well as a spring washer which insures perfect contact with the movable plates all of which are dust and weather-proof. These condensers are of very good manufacture and may be used for any purpose where a good variable condenser is required.

Received without special packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT No. 1.

RECEIVING VARIOMETER



This variometer is manufactured by the Fletcher Works, Inc., Glenwood Avenue and Second Street, North Penn Junction, Philadelphia, Pa.

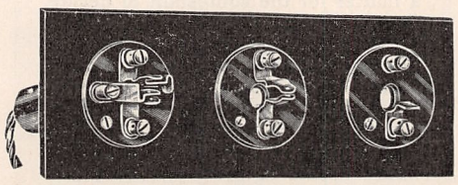
Packed in a special wooden box, the variometer was received in excellent condition.

Green silk covered wire of a heavy gauge is employed and the winding is very neat and even. Flexible leads make connection with the rotor, assuring positive contact. Metal parts are of brass; woodwork is well finished and stained and the general appearance is exceptionally neat.

Two stopping pins are provided which prevent the leads of the rotor from becoming twisted. The wavelength range when wired in series with the secondary of a standard vario-coupler was found to be 180-515 meters.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT No. 2.

RADIO JACKS



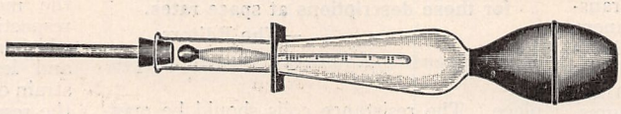
A recently developed jack of novel design now on the market, is manufactured by the Radio Improvement Company, 25 West 43rd Street, N. Y.

This type of jack differs from the ordinary ones, as may be seen in the accompanying picture. Instead of the usual long, flat spring contacts, the new jack has relatively short springs spaced farther apart than in the ordinary type. Binding posts are provided, thereby assuring easy connection. The jacks are mounted on a metal base, 1½" in diameter. Mechanical construction is good. Metal parts are nickel-plated and the general appearance is very neat. Single circuit, double circuit, and open circuit types are made.

Received without special packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT No. 3.

"READ-EASY" CHARGOMETER



The "Read-Easy" chargometer is manufactured by the Ala Manufacturing Company, 1952 Redvale Avenue, Chicago, Illinois.

The "Read-Easy" chargometer was received in a strong cardboard tube with metal caps insuring safe delivery. On the scale may be found the specific gravity and also the words "empty", "half" and "full", denoting the condition of the battery. Complete instructions accompany the meter with which the state of any lead plate storage battery may be found instantly. The readings were found to be accurate.

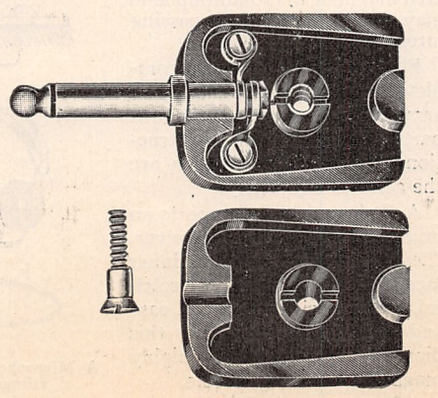
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT No. 4.

RADIO PLUG

The Sunraid radio plug, manufactured by the Sunraid Radio Company, 534 Eighth Avenue, New York City, is well constructed of good material.

The case is of hard rubber finished with a high polish. Size is about 1½" by 1¼". Metal parts are of brass.

Terminals are readily accessible; consisting of a small machine screw, they will hold any form of cord tip.

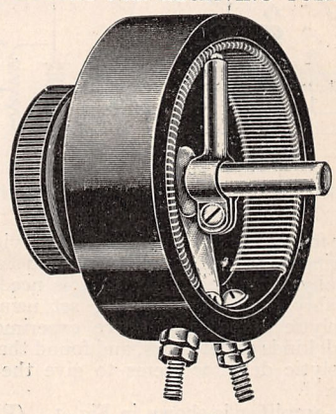


Only a single screw is necessary to clamp the two halves of the case. An item often overlooked in plugs is incorporated in this one. It is the small center section at the two openings, over which the retaining cord of the phone leads may be slipped. The wire leads are then protected from injury as the retaining cord takes any strain imposed upon the phone cords.

Received without special packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT No. 5.

RHEOSTAT FOR RECEIVING TUBES



An improved rheostat for use with receiving tubes, is manufactured by the Sunraid Radio Company, 534 Eighth Avenue, New York City.

This rheostat differs from the regular type in the method of making contact with the resistance wire, as shown in the illustration. A small length of metal tubing is fastened to the shaft and rotates when the knob is adjusted. Inside the tube is a wire spring which exerts constant pressure on a small ball-bearing at the open end. The ball-bearing is pressed against the resistance wire with enough force to assure a good contact.

Wear on the resistance wire is minimized and a very smooth adjustment may be had by this feature. Mechanical construction and finish is of high grade. The rheostat is 2⅜" in diameter. A moulded knob of 1⅜" diameter is supplied with each instrument. Tested at 1.5 amp. for two hours.

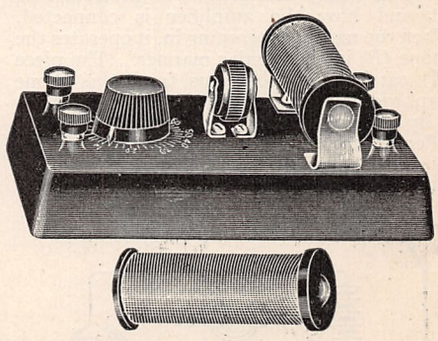
Received without special packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT No. 6.

NATIONAL AIRPHONE

The crystal receiver, shown in the illustration is manufactured by the National Airphone Corporation, 16 Hudson Street, New York City.

This apparatus is neat and well designed. A single circuit is employed with fixed inductances and a variable tuning condenser. The inductances are wound on a tube 3" long and 1" in diameter with



enameled wire. Tested on a 100' aerial, single wire, one inductance when placed in the clips, gave a range of wave lengths of 200 to 380 meters. The other coils allowed tuning over the band 580-875 meters. The variable condenser has mica dielectric and is moulded into the base.

A dustproof detector of novel design is provided and gave excellent results under actual receiving conditions. Mechanically, the set is of good quality.

The set was carefully packed in a double corrugated cardboard box.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT No. 7.

Detector-Amplifier Prize Contest

Detector-Amplifier

By WM. GRÖTZINGER

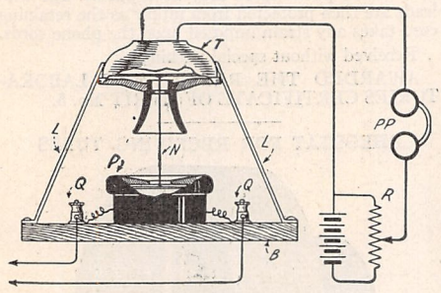


Fig. 1

Mounting of the Microphone Over the Receiver.

The following is a description of a device for rendering more loud and distinct radio signals, especially faint ones. All that is needed is preferably a simple receiving set using an electrolytic detector. I have experimented with all kinds of detectors, and found that the electrolytic detector seems to give the best results.

The amplifier is shown in Fig. 1. (P) is a telephone receiver, made fast to a base (B) 6″x3″x½″. This base has two binding posts (Q), to which (P) phone wires are attached, and from thence to receiving set as shown in Fig. 2.

(T) Fig. 1 is a telephone transmitter made fast directly over the telephone receiver (P), with a space of one inch between the telephone and transmitter diaphragms. (L) are two legs made fast to the telephone transmitter, and base (B) to hold it in a permanent position in relation to the phone (P). (N) is a piece of tooth stick made to just hold its own weight by lightly bearing between the transmitter (T) and phone (P) diaphragms. Six dry cells are used in the transmitter circuit, with a resistance coil (R) as shown, thereby obtaining the desired degree of loudness of the phones (PP), or any loud speaking device connected in their place.

In Fig. 2 there is also used a resistance coil (R) and two dry cells in connection with the electrolytic detector as shown.

To operate the amplifier it is best to first plug in the phones at X and Y (Fig. 2) and adjust the instruments in the regular manner, until the desired signals are heard. Then take out the phones and plug them in on the transmitter amplifier circuit as shown in Fig. 1.

Fig. 2 shows connections of the receiving set and how the amplifier is connected. When the message is coming in, it operates the phone (P) in the regular manner. The piece (N) carries the vibrations from the phone diaphragm to the transmitter diaphragm.

By closely adjusting the resistance coils (R), different desired strengths of current will be relayed through the transmitter to the phones or any loud speaker connected in their place. The resistance coils should be operated slowly to get the best results. Weak signals with this arrangement can be made very loud and distinct.

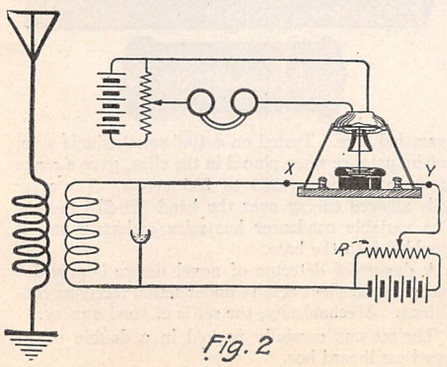


Fig. 2

The Micropnone Amplifier Connected to a Receiver With Electrolytic Detector.

Announcement

In the April-May issue we offered six prizes amounting to $350 to be awarded for best suggestions for some type of amplifier which would not require vacuum tubes for its operation. The design and construction could be a matter for the contestant to decide. Crystal or any other type of detector could be used with the exception of Fleming, or other thermionic vacuum tubes. The object of the contest was to stimulate the development of an amplifier which would be inexpensive and simple in operation and which would appeal to the public. One of the rules of the contest was that models must be submitted with each entry.

We regret to announce that we cannot award any prizes for this contest. There were only five entries and only three of these submitted models. None of these models was in working order. Two of them were composed of "junk" thrown together in a haphazard manner; it was impossible to do anything with them. They were absolutely worthless. The third we repaired at the request of the sender and tested. No amplification was obtained even when loud signals were audible with the detector alone. However, to indicate the nature of the attempts that were made by these amateurs to perfect a "crystal amplifier," we publish their descriptions of the models and will pay the contestants for these descriptions at space rates.

—The Editors.

Magnetic Micro-Ampliphone

By S. K. CULBERTSON

Microphonic amplification of audio frequencies, such as the vibrations from a radio receiver, is quite practicable, providing of course, precautionary effort is made to exclude external vibrations and adequate means are available to eliminate inherent microphonic scratches.

To the thousands of users of crystal detectors—which by the way is not so hopelessly obsolete as the V. T. devotee would indicate—a description of a very simple and successfully operated magnetic micro-ampliphone may be of more than passing interest.

Fig. 1 clearly depicts the complete apparatus—circuit and arrangement of the standard parts as well as the constructional features, all of which are the acme of simplicity.

A Z-shaped strip supports an inverted metal case receiver. Clean the edges of the inner face of the diaphragm for electrical contact with the metal case and in the center of this diaphragm solder a highly magnetized sewing needle.

Cut a glass tube of small diameter to two and five-eighths inch length; stop one end with a tight-fitting cork. Around this tube wind evenly five layers of No. 22 magnet wire, leaving a shank of ⅜″ at the open end. Insert the lower free end of the wire flush with the inner end of the cork stopper. Connect the other free end direct to one primary terminal of a 90 ohm telephone transformer. This winding constitutes the field coil, as per diagram.

Into the open end of the tube introduce a sufficient quantity of mercury to raise its level to within ⅛″ of the magnetized needle when the tube is inserted into the aperture of the ear cap. The tube should fit snugly with ample clearance from the diaphragm.

Fill the intervening space between the mercury and needle with loosely packed soft iron filings, which will float upon the surface cohering to the magnetic needle; the quantity required is best determined by experiment. The tube, its field winding and contents—mercury, filings and needle—comprise the microphonic element.

When the diaphragm is at rest a current of constant amplitude flows through the primary circuit, and if properly regulated by the battery rheostat, emits no sound in the secondary phone circuit. But the slightest vibration of the diaphragm transmitted down the needle to the magnetically cohering filings, alters their conductivity—hence the ohmic resistance of the microphonic circuit—setting up current variations which are registered in the secondary phone circuit as sound waves.

This variation of current is further amplified by the retroaction of the fluctuating electro-magnetic field of the tickler coil and the magnetic field of the needle—whose respective fields oppose—upon the iron filings, which magnetize and demagnetize to greater and less degree in accordance with the strain or stress of the magnetic fluctuations of the resultant semi-polarized field.

We can now see that the slightest mechanical movement of the microphonic coupling—iron filings and needle—is further augmented by the inter-reaction of both conductive and inductive magnetic fluctuations, supersensitizing the cohering and decohering inertia of the filings to both magnetic and mechanical vibrations. In this manner inaudible vibrations of the primary receiving diaphragm register audibly in the secondary receiving phones.

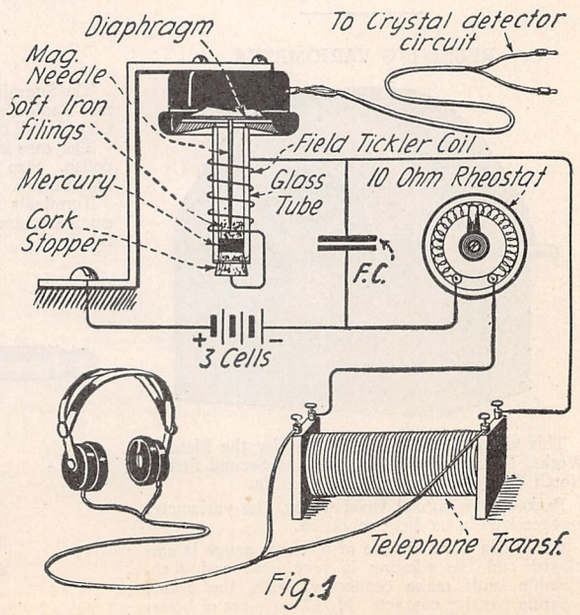


Fig. 1

A Microphonic Amplifier Which is Said to Be Efficient. The Iron Filings Are Submitted to the Action of a Magnetic Field.

The Detective Detector

By PERRY POORMAN

IT was a bitter cold evening and Howard Hagen was glad to spend the evening in his room at the Grand Hotel.

The secret of his joy was a portable radio receiving outfit which he always carried with him on his business trips.

He had come to Cambridge (Ohio) on business and had decided to spend the night there, because his business had made him miss the last west-bound train of the day.

As he had just closed a contract for a big order of machinery for a Cambridge glass and pottery concern, he was feeling in high spirits.

His receiving set was modeled after the famous "suit-case set," recently shown and described in RADIO NEWS.

KDKA had come in strong, as he was comparatively near to Pittsburgh. After he had yawned his way through a dry lecture on personal hygiene, the concert started and he was thoroughly entertained by the University Glee Club.

There Behind the Seat Sat a Man at an Instrument Board, with a Microphone in His Hand. He Was So Completely Surprised That Before He Could Give Warning He was Overpowered.

As soon as KDKA "signed-off" he tried to tune in some other later station, but was unsuccessful.

He turned off his filament and picked up a paper.

He soon tired of this and decided to go to bed.

It did not take him long to climb into his pajamas and slip in between the cool sheets.

In order to take a last glimpse of the paper, he turned on a lamp which was located at the head of his bed.

An overdrawn discussion of the Eighteenth Amendment held his attention for a few minutes, but without realizing it he soon dropped off to sleep with his lights burning

* * * * *

He awoke with a start.

A heavy truck had come down the street and stopped outside his window, with its motor still going.

He lay there hoping it would either go on or stop its noise, but the motor continued.

Just as he got up to see what was happening the motor stopped.

As far as Hagen was concerned, it might as well have continued for he was wide awake by that time.

He glanced at his watch; it was 3 o'clock!

An idea suddenly occurred to him. He had always wanted to try his "ear" on some spark stations and thought he would try to get some of the commercial stations which might be operating at that time.

During the war he had been stationed at an important wireless station on the French coast. His knowledge of French and German, as well as wireless telegraphy, made him a valuable man in locating German U-boats.

He picked up a few stations, but most of them were using code and he soon lost interest, and besides, he was getting sleepy again.

He was just about to turn off his filament when he heard a voice. It was quite incoherent, but he soon tuned it in.

It still sounded odd.

He tuned a little closer and received a great surprise.

Someone was talking fluent French.

For a minute he felt the same nervous tension he had experienced at his post during the war. It soon passed away and he was listening eagely for every word.

"*On s'approche!*—Here comes somebody," a voice was saying.

The voice continued in French.

"All right, go ahead and use your light."

The orders continued: "Turn off your light—now, go ahead. Bring just those things we can use."

Hagen was plainly perplexed. Who could be using a radiophone at that hour—and using such French?

He intuitively glanced out the window, as though there was someone out there doing the talking.

Instead, there stood a huge moving van, packed with furniture, one wheel jacked up, and a man struggling to put on a new tire.

The strange orders continued for over a half hour. One man was evidently advising and controlling the movements of another by radio.

"Why should they use French?" he puzzled.

After he heard the words "*guetteur*" and "*gendarmes,*" he became suspicious; they meant "watchman" and "police."

Somebody was up to mischief and the police should know. But what could he tell them? Simply that someone was talking suspiciously in French over a radiophone.

They would just laugh at him.

He longed for some of the instruments he had had at his post in France. He could have located their direction anyway.

As his room was getting cold, he closed the window and climbed into bed, leaving the unknown Frenchman to "rave on" as he drowsily expressed it to himself.

His sleep was once more disturbed by the motor-van outside; evidently the tire had been replaced and the van went roaring down the street.

He awoke late the next morning. It was fortunately Sunday and he could sleep off the excitement of the previous night.

He arose and occupied himself, until dinner, with his shave and bath.

Later he went down to the writing room and dictated a letter to his firm, telling of his success of the day before.

Finding he still had some time before dinner, he bought a paper and settled down in the lobby.

Across the top of the first page was the headline, "Daring Robbery Committed Last Night."

Hagen gasped.

What a fool he had been! He had had first-hand evidence of it all and yet did nothing with it. Yet, he reflected, he had no way of locating the transmitting station. It could have been miles away.

He read on:

"The thieves must have had an advanced knowledge of electrical systems for they entered Bijou's jewelry store without giving any alarm. The lock had been pulled out of the vault-door and the vault ransacked without any alarm being transmitted to the police station." An itemized list was given of the rare jewels and stones which were missing. A reward of $3,000 was offered for the arrest of the thieves.

He debated the idea of telling what he had heard to the police and decided against it. He expected to be in that part of the country for a while and he'd try for that reward himself.

As he ate dinner he recalled the monologue he had heard the night before. There wasn't anything in it which could be used as a clue to their whereabouts.

The Bijou jewelry store was almost directly across the street from his room. The transmitting station must have been close.

Then the van suggested itself to him.

To all appearances it was an innocent moving-van. The tire trouble appeared accidental, but—he drew a long breath, amazed at his detective qualities—but where did the truck go? The truck bore a name with the words Cambridge and Zanesville.

He finally concluded that to keep up appearances they would have to be in either town, or else along the way.

He became so excited that he could hardly finish his dinner. He decided to stay over in Cambridge another night to see if he couldn't "pick-up" more of the Frenchman's orders.

(*Continued on page* 564)

It Happens to the Best of Us

A Howling Monologue in One Hectic Scene

By ORTHERUS GORDON

SCENE: A narrow room on the upper landing of the back stairs with just enough moonlight slanting in from the east window to distinguish a small deal table covered with apparatus. A loud speaker with a vertical horn like that of an old Edison phonograph is the most conspicuous object, while on the table and apart from the other instruments are a regenerative receiver of a well known make, a two-step amplifier and a pair of radio phones. On a shelf above the table is a self-constructed panel with Radiotrons, transformer, inductance and condensers behind it—it is a radiophone transmitter. The walls are covered with postcards bearing on them some mystic number and three or four letters. A heavy tramping is heard on the stairs and the Radio Bug Pre M enters the room. He is about twenty-five years of age, wears horn-rimmed glasses of approximately the same age and looks like a bird of prey. He is followed by three men who are visitors picked up at the regular monthly meeting of the American Legion which has just ended. With the true instinct of his kind Radio Bug Pre M notices the moonlight, senses the magical effect of it shining on the instruments and does not turn on the room light. Instead he pushes home the plug of the head phone and lights up the bulbs in the regenerator and in the amplifier. He lifts the lids and fills the room with a soft and mysterious glow. The visitors are almost overcome by the strange mixture of the scientific and the romantic, but manage to seat themselves on chairs in front of the loud speaker. Radio Bug Pre M sits at the instrument table and adjusts the head phones to his head. He speaks.

Have You Noticed That it is Always When You Want to Show Your Set to Some Friends That the Darn Thing Does Not Work?

RADIO BUG PRE M: "I can fill this whole room . . . . and with the best music there is. I'll show you. I promised you fellows something good and I'll give it to you . . . . Of course, you don't always get something right away—I've played for five and ten minutes sometimes. Whow! I wish I could stop this confounded detector tube from howling . . . . This is funny. Listen."

He plugs half way in on the second step of the amplifier and a series of howls, grunts and groans emanate from the loud speaker, punctuated by crackling sounds. The visitors laugh and he laughs with them. He springs a stock joke about the speaker having a howling good time and then goes on to explain the reason for the noises.

"That's static—the fire-cracker stuff—and I'm working on an eliminator, my own idea. Here it is. All I have to do is hook it up here, and—". He suits the action to the word and shunts a black box across the aerial and ground. The noises stop, and only silence comes from the loud speaker. "That gets rid of it all—now to perfect it so that the signals get through, and I'm a made man. Yes, sir, I'm a made man." He waves the black box tantalizingly before the faces of his guests, and returns it carefully to a drawer. "It'll make me rich . . . . But that's not getting you fellows a concert."

He readjusts the headpiece, returns the plug to first step and turns the condenser and the tickler dials coaxingly. He leaves the inductance alone. Occasionally he stops, catches at the phones, makes a gesture for silence— of which there is nothing else—and listens intently. Then he speaks again.

"To give you fellows an idea of how sensitive this instrument is—" He throws in the loud speaker again and moves his hands to and from the regenerator as if hypnotizing it. The howls increase and decrease with the motion. "Someone might tell you that a child can operate it—but I'm here to tell you that not even I can get anything out of it at times." Radio Bug Pre M is stalling, and he knows it. His visitors know it—and one of them asks a question.

"Not just at present. . . . Yeah, I know what the programs say, but they're on daylight saving. . . . That's so too, it's the other way, isn't it? Ought to get something. Well, I'll try her now . . . . Suffren cats! Listen to this thing. Howl, you pesky critter, howl! There's a human voice in there somewhere, but it's awfully distorted. If I could only get the thing in tune. . . . Nope, can't do it. While we are waiting, I'll give you fellows a little local stuff—I'll call up 8BVZ—that's Pete the Grinder—and ask him to send something back so that you can hear him. That's almost as convincing as a concert from Pittsburgh."

Aerial Bug Pre M drops the aerial switch and four Radiotron bulbs light up behind the panel, and a persistent buzz comes from the transformer. He plugs in the transmitter and watches the hand of the ammeter. He whistles and speaks expressively. "Wow! *Eight Hundred Milliamps!*" His meter reads eight tenths of an ampere, but anything to be big and sensational. "This ought to raise the dead. . . . I've been heard all over the state—read these post cards on the wall if you doubt it. . . . Hello, Pete; Hello, Pete: Pre M calling, Pre M calling. Will you come back with some speech and a little music? I want to try her out. I want to try her out. Come back, Pete. Signing off. There! That ought to get something. . . . Where in thunder is he? He always comes in on—that's it, I forgot to change the inductance. His is three, one. . . . Ummm. Not there. . . . If you fellows will excuse me a moment, I'll call him by the regular phone below."

Radio Bug Pre M leaves the room and clutters downstairs to the phone. The three visitors look sheepishly at each other in the dim light of the bulbs plus the silvery light of the moon and grin. One of them touches and moves a knob on a separate piece of apparatus lying idle on the table. A loud bell clangs. "Don't touch any of that stuff up there!" This from downstairs. "It's all connected up with an alarm system. My own idea." "Something works," mutters the visitor with a laugh. The Radio Bug Pre M returns from downstairs and goes to the sending set again.

"He'll listen for me this time—and then I'll show you fellows. I'll give it a little more juice. Seven and a half, eight, eight and a quarter (shouldn't give you more than seven and a half, old girl) just a little more. Well, I'll be—!"

One of the bulbs goes out, and the one in series with it brightens up quickly, emits a little purple flame and goes out also. Radio Bug Pre M turns the other two off, and begins to swear. He was a top sergeant in the army during the war.

"Pop, pop—there goes sixteen dollars. But I'll get something for you yet."

The phone rings and Radio Bug Pre M goes down to answer it. The visitors confer together and then rise to go. Pre M meets them at the top of the landing, hustles them back again into their chairs, goes to the East window, throws it open and swings a switch just under the window ledge. It is the lightning switch.

"Wait a minute, you fellows—now I've got it. That confounded switch! Sit down, sit down, the evenin's just started. Now for some wonderful music."

He turns to his instruments, finds a carrier wave of a phone and shifts it hurriedly to the loud speaker. "There!" True enough! He sits back to enjoy the look of surprise on the faces of his weary friends.

Loud and clear the voice in the bottom of the speaker says: "In my talk on the organisms of the various plants found in the northern part of Patagonia, which will occupy the remaining half hour of this evening's entertainment, I shall take up the most rare first—starting with those that were collected during the recent research of the—"

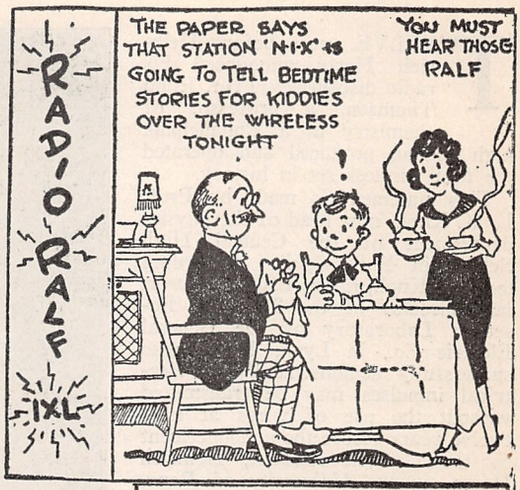
Radio Bug Pre M picks up the loud speaker, wrenches it from its table moorings and drops it out of the window. Then crosses the room to shake his fist at his departing guests, who are stumbling down the stairs and choking with laughter. He tears the cards from the wall.

CURTAIN.

DOWN ON THE FARM

The farewell party of Henry Wilkins was well attended last night. Wilkins is a local farmer and is going to move down to Indianapolis so that he can get radio broadcasting on a small crystal-detector outfit, which a relative living at Detroit sent him as a birthday gift.

Radio Humor

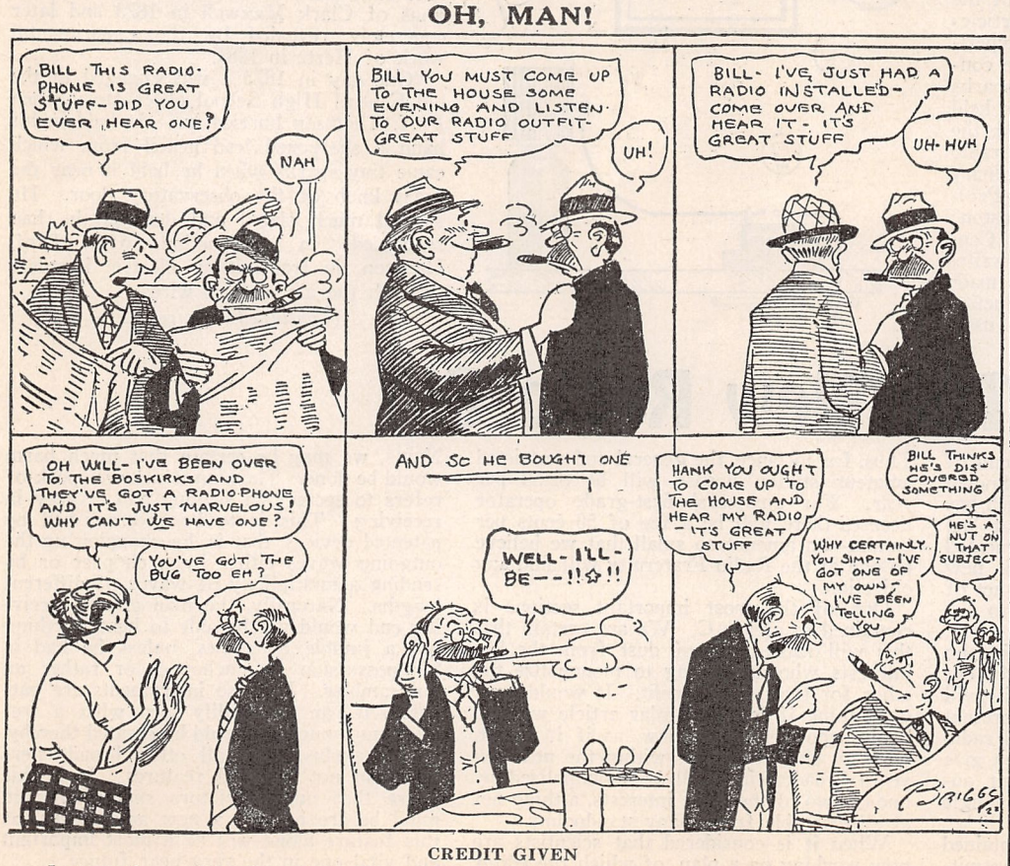


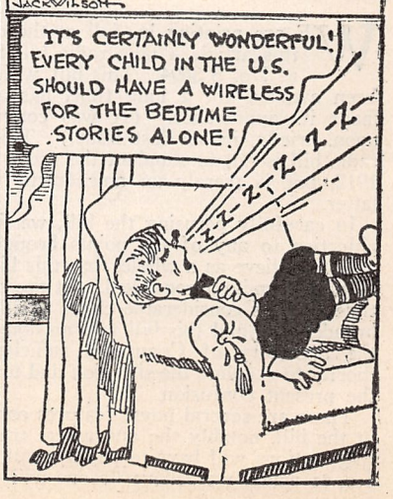
Left: Abstracted from the N. Y. Globe

Right: Abstracted from the N. Y. Evening Telegram

Below: Abstracted from the N. Y. Tribune

OH, MAN!





CREDIT GIVEN

Last month we published puzzle drawings entitled "Simplified Radio". By an oversight, we failed to give credit, for suggesting these, to Mr. Edward Bratter of New York who submitted rough sketches of the drawings. We correct this with apologies to Mr. Bratter.

Who's Who in Radio

No. 19 PROF. ELIHU THOMSON

TWELVE years before Heinrich Hertz announced his radio discoveries, Prof. Elihu Thomson, a professor of chemistry in a Philadelphia high school, produced and operated the first wireless set in history.

This statement is made by Prof. L. M. Knoll, now head of the physics department of the Central High School in Philadelphia. According to Prof. Knoll, it was Prof. Thomson, now director of the Thomson Research Laboratory of the General Electric Co., in Lynn, Mass., who successfully demonstrated that electrical impulses may be transmitted without the use of wires at least twelve years before the announcement by the German scientist, Heinrich Hertz, of the University of Bonn. Hertz, in 1887, informed the scientific world of his discovery that electro-magnetic waves sent out by induction coils, or other suitable apparatus, may be caught by a receiving apparatus without the use of wires.

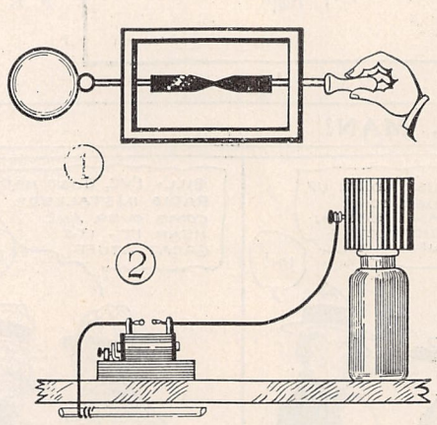
Following up the experiments of Hertz, Marconi produced the first practical wireless apparatus and adapted it to commercial use. Prof. Thomson, according to Prof. Knoll, made no practical application of his work, but conducted it solely as experiment.

In the *General Electric Review* of May, 1915. Prof. Thomson describes his experiments with the first radio set. His statements there made are corroborated in an article in the March 20 issue of the same publication by Prof. Monroe B. Snyder, a former instructor in a Philadelphia high school.

In the early issues of the Journal of the Franklin Institute for 1876 appear articles by Prof. Thomson describing radio experiments begun as far back as 1871. He conducted experiments whereby electric sparks were drawn from blades of penknives held near water pipes leading to the ground, the sparks being produced as the result of radio waves sent through the air by an ordinary induction coil. Credit is given by Prof. Thomson to his colleague, E. J. Houston:

"While we were both teachers in Central High School, at Philadelphia," writes Prof. Thomson, "this experiment was made about the latter part of 1875. An induction coil with a two-inch spark gap was used.

Prof. Elihu Thomson, Who, It Is Claimed, Carried Out Some Wireless Transmission Experiments in 1875. Below is a Sketch Showing the Apparatus He Used



For the receiver we used a black box (Fig. 1) open on one side, with two graphite pencil points adjusted a fraction of an inch apart inside, one pencil being connected with a large brass ball outside.

"We observed a tiny spark between the two pencil points. It was an indication of a shock, commotion or wave, electrical in its character, in the ether. As an aerial on our sending apparatus we used a large tin can on top of a glass jar, insulating it from the table, the can being connected to one wire of the secondary of the induction coil.

"Tests for detecting the impulses were carried on not only in rooms on the same floor (the basement) in which the induction coil was located, but we went from floor to floor, finally reaching the astronomical observatory on the roof, more than ninety feet from the physics room and separated from it by five brick walls. We found here that even metal pieces not connected with ground wires would yield sparks.

"It was understood by us at the time that after each discharge of the coil there was a shock or wave in the ether, consisting of a quick reversed electrical condition, and it was even imagined there might be in the process the germ of a system of signalling through space.

"This old work was almost forgotten when it was recalled by the later work of Hertz in 1887."

Writing in corroboration of his former colleague, Prof. Snyder declares:

"Prof. Thomson in 1875 experimentally discovered the long electro-magnetic waves first announced in the mathematical deductions of Clark Maxwell in 1873 and later concretely revealed by the experimental work of Hertz in 1887.

"One day in 1875 I was engaged in the old Central High School observatory when Prof. Thomson hurried in. He held in his hand a sharpened lead pencil from which came tiny sparks when he held it near the brass knob of the observatory door. He seemed much elated and declared he had succeeded, in conjunction with Prof. Houston, in transmitting electric impulses through the air without wires.

(*Continued on page* 581)

The New Radio Bill

WE are printing in full at the end of this article a new radio bill known as No. S 3694. This bill, which has been awaited for a long time, has at last made its appearance. (It was commented upon, briefly, in our last issue.) This new radio bill is not to supplant the radio act of 1912, but is merely an amendment to the latter.

In carefully perusing the bill, we find no objection to any of the points brought out and we believe as a whole, that this bill will help radio quite a good deal. At the present time there is considerable chaos in all radio broadcasting and this bill will no doubt give the Secretary of Commerce sufficient authority to regulate the situation and untangle the present confusion.

There are several novel features contained in the bill, notably the one where transmitting stations will have to pay a small yearly fee, to which we believe no one will object. Thus, for instance, the general and restricted amateur station license will be $2.50 per year. For amateurs' first-grade operator licenses there will be a fee of 50 cents per annum—an amount so small that we believe no one of the Radio Fraternity will find any objection.

One of the most important sections is contained in article C. We are certain that this will raise a lot of dust from the big interests who are trying to monopolize the ether for their own benefit. It would be a good thing if this particular article were to be incorporated in the law, as if it is not, we may be certain that within the next ten years broadcasting will be monopolized by one or two of the large interests, a thing not at all desirable from many standpoints.

When it is considered that scientists are now working on a plan, of which the editor of this journal has made mention before in SCIENCE AND INVENTION, as well as in RADIO NEWS, we may be certain that much harm would be done. The plan which we speak of refers to secrecy in sending and secrecy in receiving. This is to be accomplished by patented devices, that is, by chopping up the outgoing waves either by a chopper or by sending a multiplicity of waves of different lengths. Naturally, the man at the receiving end would not be able to hear anything but a jumble of noises, unless he had in his possession an unchopper or rather an unscrambler. If these instruments are patented, it can be readily seen what a tremendous monopoly would be created thereby, to the exclusion of all other broadcasters who had not patented features. It is this phase that our legislators should bear in mind before passing a new amendment, as this feature alone will be a most important and vital one in the very near future.

In section 4 is found also an important

(*Continued on page* 582)

Radio Digest

NEW RADIO PUBLICATIONS

A paper by R. T. Cox, entitled, *Standard Radio Wavemeter, Bureau of Standards Type R70B*, describes a standard wavemeter constructed at the Bureau of Standards and used in the standardization of radio apparatus.

An Electron Tube Amplifier for Amplifying Direct Current, a paper by H. A. Snow, describes an amplifier which has been developed at the Bureau for particular applications in electric signaling work, and can be used in place of a polarized relay and also for various other purposes, including the recording of telegraphic and radio signals.

E. L. Hall and J. L. Preston have prepared a report entitled, "High-Voltage Storage Battery for Use with Electron Tube Generators of Radio-Frequency Currents", describing a special type of storage battery developed at the Bureau. This battery employs a considerable number of small storage cells contained in small glass jars, about 1½ inches square and about 4 inches high. The cells are assembled very compactly in trays which can supply 100 volts.

NINE MONTHS OF BROADCASTING

On June 30th the Department of Commerce licensed the 382d broadcasting station, issuing 21 during the past week. Within nine months all these broadcasting stations have sprung up until to-day the air is literally charged with news, music and data of various sorts. The future of radio telephonic broadcasting seems assured, as the remarkable growth still goes on at the rate of about three new stations each day.

Since the advent of broadcasting only ten stations have dropped out of the new and fascinating game, and most of those on account of the termination or transfer of a business or due to the death of the owner. Among the recent stations *deleted* are the following:

KGC—Electric Lighting Supply Co., Hollywood, Cal.

KQL—A. A. Kluge, Los Angeles, Cal.

WGH—Light & Water Power Co., Montgomery, Ala.

WPB—Newspaper Printing Co., Pittsburgh, Pa.

WQB—C. D. Tuska, Hartford, Conn.

KOJ—University of Nebraska.

Among the new stations listed recently is the first department of the American Legion to take up broadcasting, the Nebraska Department of this organization having been assigned the call, "WGAT," the last three letters of which seem to have a special military significance and recall a weapon with which most veterans were familiar not so long ago.

A newspaper in Fort Smith, and one in South Bend, have put in broadcasting stations, making nearly fifty dailies with private stations, while three more universities have opened stations.

FOREIGN RADIO ACTIVITIES

The Radio Telegraph Direction Service of the Hellenian Royal Navy has practically completed a new 60 k.w. radio station at Athens to handle official messages. This station, which will be known as SXG, will clear a large number of official messages previously transmitted by Coast Station Athens No. 2 (SXB), which is open to general public correspondence. The state of war in Greece has so increased the number of messages as to overburden this station, making it impossible to insure communication for the public. Desiring to improve public radio communication, especially with ships, the Radio Telegraph Service will open station SXG for official communication, thus permitting SXB to operate exclusively for the public.

RADIO TRAFFIC WITH GERMANY INCREASES

The "Drahtlose Uebersee-Verkehr, A. G.," or Overseas Wireless Company of Germany, has attained a new record for wireless service. On March 16th a total of 50,000 words were exchanged via radio at the wireless stations of this company at Nauen and Eilvese. Since the reconstruction of commercial relations, the traffic through these wireless stations has been steadily increasing. In August, 1919, the entire business for the month amounted to only about 100,000 words. It increased to 550,000 words in June, 1921, and in February, 1922, rose to 1,000,000 words.

NEW EUROPEAN RADIO SERVICE

Experimental transmissions have begun between Leafield, England, and Cairo wireless stations, and as soon as the preliminary trials are complete a public service will be inaugurated.

Denmark is using radio to protect her ships from icebergs. Whenever necessary, the coast station of Blaavand reports the presence of icebergs in Danish territorial waters at 12.20 and 22.20 (Danish time).

Radio Articles in This Month's Science and Invention

Marconi Explains Directional Radio
By A. P. Peck
Radio Telephone and Aircraft
By S. R. Winters
New Radio Loud-speaker and Power Amplifier
Radio Set in a Table Lamp
The Detectorium
Radio for the Beginner—No. 6—How to Get More Sound Out of the Receiver
By Armstrong Perry
Insulators from Bottle Necks
How to Build a Crystal Detector
Simplest Radiophone Receiver
By J. T. Lansing, Fourth Prize Winner
Radio Broadcast
Radiophone for Lighthouses
$100.00 Prize Contest Announcements—How to Build a Loud Talker
Radio Oracle
Movies Actually Sent by Radio
By S. R. Winters
(Special exclusive article, with diagrams and photos)

RADIO SUGGESTED AS ADAPTABLE TO MINE RESCUE WORK

The possibilities of wireless telephone in connection with mine-safety and mine-rescue work has been suggested to the United States Bureau of Mines. The suggestion has been made that, by use of high-power sending stations at the bureau's experimental stations at Pittsburgh, Pa., and Salt Lake City, Utah, messages could be broadcasted to the various mine-safety offices and cars stationed throughout the country. Mine-safety programs and instructions could be sent to the various chapters of the Joseph A. Holmes Safety Association, located in the different mining centers. Aerials have been installed on trains in Germany and the United States, and it is pointed out that it would be entirely possible to build similar aerials on the mine-rescue cars of the Bureau of Mines. Field engineers of the bureau have reported that the radio is already in wide use in the different mining centers.

WASHINGTON POST OFFICE NOW PHONES ALL MATTER

Commencing July 1st, Station WYX of the Post Office at the Capital began to broadcast all its varied information on the radiophone on 1,160 meter waves, so that all may get the latest weather, crop and market news without knowing code.

The daily schedule, except for the Saturday closing at 1 P. M., is as follows:

10.00 A. M.—Weather (Eastern Central only).
10.30 A. M.—Washington wholesale fruits and vegetables.
12.30 P. M.—Live stock, openings St. Louis and Chicago (Form 41).
2.15 P.M.— Chicago and St. Louis live stock closing (Form 20).
3.00 P. M.—Crop report and special market news.
3.30 P. M.—General fruits and vegetables.
5.00 P. M. Wholesale dairy produce, New York and Chicago (Form 59).
5.30 P. M.—Grain report.
7.30 P. M.—Live stock and grain (Form 43).
8.00 P. M.—Fruits and vegetables.
9.30 P. M.—Weather.

LIST OF LIMITED COMMERCIAL BROADCASTING STATIONS LICENSED BETWEEN JUNE 24TH AND 30TH

WGAJ—W. H. Gass, Shenandoah, Ia.
WGAL—Lancaster Electric Supply & Const. Co., Lancaster, Pa.
WGAN—Cecil E. Lloyd, Pensacola, Fla.
WGAH—New Haven Electrical Co., New Haven, Conn.
WGAM—Orangeburg Radio Equipment Co., Orangeburg, S. C.
WGAT—American Legion, Department of Nebraska, Lincoln, Neb.
WGAU—Marcus G. Lumb, Wooster, O.
WGAQ—W. G. Patterson, Shreveport, La.
WGAS—Ray-di-co Organization, Chicago, Ill.
WGAR—Southern American, Fort Smith, Ga.
WHAA—State University of Iowa, Iowa City, Ia.
WHAB—Clark W. Thompson, Galveston, Tex.
WGAZ—South Bend *Tribune*, South Bend, Ind.
WGAW—Northwestern Radio Co., Madison, Wis.
WHAD—Marquette University, Milwaukee, Wis.
WHAE—Automotive Electric Service Co., Sioux City, Ia.
WHAC—Cole Brothers Elec. Co., Waterloo, Ia.
WHAF—Radio Electric Co., Pittsburgh, Pa.
WGAV—B. H. Radio Co., Savannah, Ga.
KFAJ—University of Colorado, Boulder, Col.

NEW STATIONS OPENED IN EUROPE

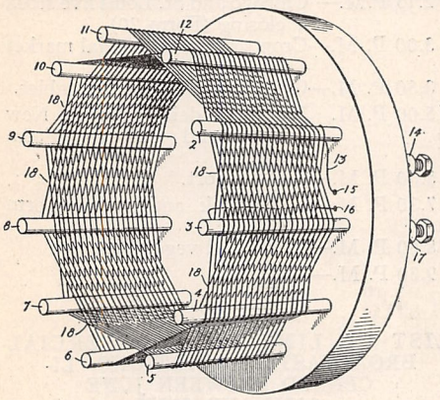
A radio station has just been established at Kaisariye, Anatolia, from which the first message was sent to Moscow. The Angora Government announced that another radio station would be opened at Mersina for use in communicating with European capitals.

RADIO BOON TO U. S. LIGHTHOUSE SERVICE

IMPROVED service to shipping and better living conditions for members of the U. S. Lighthouse Service have resulted from the use of the radio, according to the Department of Commerce.

Formerly, a tender would be dispatched from a lighthouse depot to repair or replace a buoy. After a round trip of perhaps several hundred miles it would often be necessary to repeat the journey to take care of another buoy in the same general locality. The radio is eliminating this waste of time, money and materials as the vessels can now be kept informed wherever they are located.

(*Continued on page* 506)



A New Inductance Winding Said by the Inventor to Lower Distributed Capacity to a Minimum is Shown Above.

DIFFERENT TYPE OF INDUCTANCE COIL

(Patent 1,409,352. Issued to Samuel Adair, New York. March 14, 1922.)

The object of this invention is to provide a coil in which the distributed capacity is reduced to a minimum. In continuous layer windings, there is a distributed capacity effect within the winding itself due to the difference in potential between turns. In order to obtain a coil having a low distributed capacity and at the same time one that is not prohibitive in size, this invention provides a winding in which the adjacent turns do not lie next to one another but cross at right angles around the circumference.

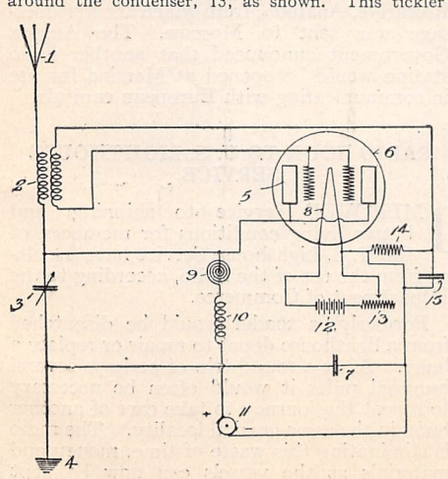
This construction will be clearly understood by referring to the accompanying drawing which shows an inductance coil wound in the manner proposed by the inventor. An odd number of guide-pins or spindles is used and these are set perpendicularly to the base. It will be noted that the adjacent turns of wire come in contact with each other only at the point where they cross between the spindles as at the point 18. At all other points, they are separated from each other by a distance which reaches a maximum at the spindles as illustrated.

NEW TRANSMITTING SYSTEM

(Patent 1,417,662. Issued to Dr. Lee De Forest. May 30, 1922.)

The object of this invention is to provide a radio signalling system employing an oscillion which is simple in structure, efficient in operation and economical to manufacture. The diagram shows the system embodying this invention. In the drawing, 1 designates the antenna which is connected through an inductance 2 and variable condenser, 3, to the earth in the usual manner. The plate of the oscillion, 6, is connected to one terminal of the condenser, 3, and the opposite terminal is connected through a condenser, 7, to the filament of the tube. The plate is also connected through an impedance coil, 9, and inductance, 10, to the filament.

The special purpose of this invention is to provide what is termed a "tickler circuit" from the grid to the filament, preferably with a high resistance leak shunted across. Preferably, the grid leak is shunted around the condenser, 15, as shown. This tickler circuit from the grid to the filament is inductively coupled to inductance, 2, of the antenna system. With this arrangement it is found that the efficiency of the transmitting system is greatly increased.



This Transmitting Circuit is Reported to be More Efficient than the Hook-Up Generally Employed.

ELECTRIC DISCHARGE APPARATUS

(Patent 1,413,732. Issued to Raymond A. Heising, East Orange, N. J. April 25, 1922.)

This invention relates to electric discharge apparatus and particularly to apparatus employing three-element vacuum tubes. The object of the invention is to afford a means whereby one or more vacuum tubes can be supplied with a negative voltage for the grid through the action of an oscillation generator system or its equivalent. In so obtaining a negative voltage of the grid, the necessity of using polarizing batteries or other sources of electricity is eliminated. In a system for use on airplanes, this has an important advantage in simplifying the system and decreasing its weight. An even more important advantage resides in the superiority of this invention in maintaining a constant working voltage on the grids of one or more vacuum tubes of the system. In applying the invention, the current which flows between the filament and grid of a oscillation generator is caused to flow through a resistance. The drop of potential across the whole or portion of this resistance serves as a source of uni-directional voltage for any desired system including the oscillation generator itself.

Fig. 1.

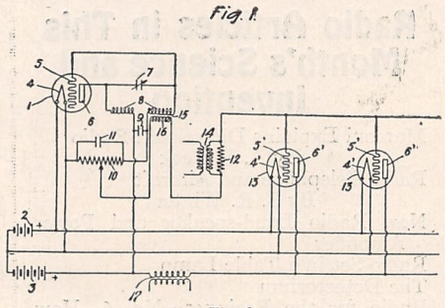
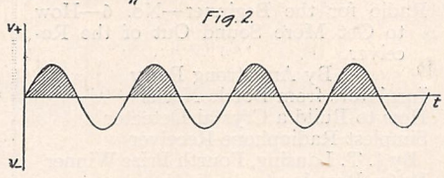


Fig. 2.



By the Proper Use of Audions the Inventor of This Circuit Has been Able to Dispense with the Polarizing Batteries.

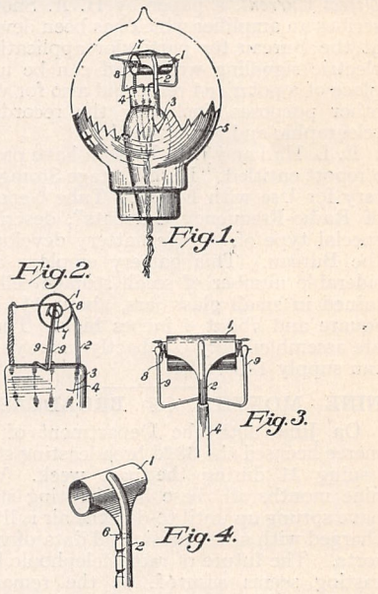
In Fig. 1, one is a vacuum tube of the Audion type which constitutes an oscillation generator. The primary oscillation circuit of the generator consists of the capacity, 7, and the inductance, 8. Since the grid and plate are connected by a metallic circuit, they tend to remain at the same potential, but the production of oscillations in the circuit causes the grid to be alternately positive and negative with respect to the filament; this is shown by the curve of Fig. 2 in which the potential of the grid with respect to the filament is plotted against time. The metallic circuit across the grid and filament contains the resistance, 10, and capacity, 11. As oscillations occur in this circuit, there is a substantially uniform fall of potential across the resistance, 10. This fall of potential may be used as a source of negative voltage for the grids included in the system.

The arrangement shown is illustrative only, and it will be possible for those skilled in the art to devise various modifications embodying the invention.

VALVE OF WIRELESS TRANSMISSION SYSTEM

(No. 1,394,090, issued to Cassius Eugene Hiatt and William Joseph Davis.)

This invention relates to improvement to the valves of the French type. These valves consist in general of a filament which is the generator of the electrons surrounded by coiled grid, while outside of the grid and concentric with it, is a cylindrical plate forming the anode which is the collector of the electrons. As at present constructed, the plate aforesaid is connected by electric welding to the upper end of a metal rod which is embedded in a glass support. The process of electric welding is an expensive and difficult operation and, moreover, tends to introduce joints having variable electric and thermal conduction between the plate and the rod. The object of this invention is to provide a structure of increased rigidity in which there will be a higher thermal conductivity between the plate and its support, and at the same time provide a less expensive process of manufacture. In the accompanying drawings, Fig. 1 is a perspective view of a complete valve. Figs. 2 and 3 are a side and end view of the electrode mounting, Fig. 4 showing a perspective view of a modification of the invention.



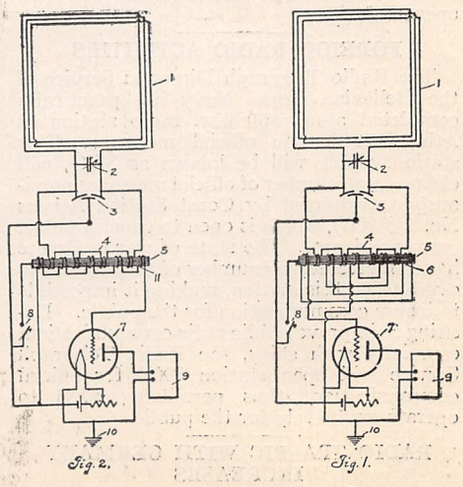
This Method of Supporting the Elements of a Vacuum Tube Increases the Efficiency and Lowers the Cost of Manufacturing.

AN IMPROVED LOOP RECEIVER

(Patent 1,405,905. Issued to Francis W. Dunmore. Feb. 27, 1922.)

In this system, a special type of transformer is used to impress the voltage on the grid of the receiving tube. In the usual type of receiver, when the loop is connected directly to the grid, the loop acts as a capacity area; one end being nearer the ground potential than the other, because the filament battery is connected to one end of the coil and grid to the other, thus giving, through the battery, a relatively large capacity to earth, as compared to the very slight capacity of earth from the small grid. Voltage is also impressed upon the grid, of course, by virtue of the fact that the loop with its condenser is in resonance with the incoming wave. As the coil is rotated, the impressed voltage ranges from zero to maximum and is the useful voltage for directional work. The induced voltage by reason of the capacity of the loop is undesirable because it tends to obscure the working point of zero. This invention reduces the capacity effect to ground and provides a sharper effect, thereby improving the operation of the coil which is an interference preventer and valuable as a direction finder. Fig. 1 represents the circuit showing the iron core coupling coil and the method of winding it. Fig. 2 shows another method of winding this coil; it will be

(*Continued on page* 578)



The Value of a Loop Receiver s an Interference Preventer and Direction Finder is Increased When Used in Conjunction with the Circuit Shown Above.

Correspondence from Readers

SIMULTANEOUS BROADCASTING

Editor, RADIO NEWS:

The writer has just returned from an extensive trip throughout the Middle Western territory as far west as Kansas City, north to Duluth and south to Cincinnati, making a survey of conditions in the included region from a radio point of view. One of the most striking and outstanding features, very little understood by Eastern manufacturers of radio apparatus accustomed to the excellent broadcasting from WJZ and KDKA, is the great number of conflicting and inferior station programs being sent out and the tremendous amount of interference and apparent lack of cooperative spirit among the various broadcasters. I never believe in making an adverse criticism without offering a constructive suggestion to remedy the condition criticised, and would be pleased to hear your comments on the plan which I have outlined to the trade and others and which has been most cordially received by many. It is as follows:

That arrangements be made by distant broadcasting stations to subscribe to the programs of one of the large and well-equipped New York stations to be sent to them over the wire and to be relayed by them broadcast, to cover their local territory.

By this means two notable problems would, in a large degree, be solved, i.e., the expense of maintaining adequate and successful broadcasting service would be divided amongst many and distributed over a large area catering to great numbers of people, and the interference would be reduced to a minimum. It is just possible that eventually the subscription expense in each locality might be covered by municipal appropriations, but in the meanwhile either the alert newspapers or the electrical trade have an opportunity to obtain some worth-while publicity at a cost which should not by any means be prohibitive.

W. GUILD,
General Manager, Radio Technical Laboratories.

YES, THE RADIO TELEGRAPH IS STILL HERE

Editor, RADIO NEWS:

The article in the June issue by Mr. Ralph R. Garrick made such an impression on me that I decided I would start the old mill going, and this letter is the result.

At present there are many predictions being made for the future of the radiophone. I sincerely hope that no true "bug" will get the radiophone fever for the simple reason that it never will give the same thrill that the telegraph does. As one fellow said, "It is too easy. Just make one or two minor adjustments and speak into the transmitter or listen-in." Another fault is the short distance covered.

On the other hand, the telegraph is the ideal thing. There is more pleasure in adjusting the set than hollering into a radiophone a century. Oh, boy! The thrill you get when you place your hand on the key knocks the shimmy cold. As I see some radiophone enthusiasts gathering bricks I will have to QRT. In the meantime let me hear what you other fellows think.

JOSEPH WARREN,
Chattanooga, Tenn.

RELAYING BROADCAST

Editor, RADIO NEWS:

With reference to article in June RADIO NEWS, C. & S. C., page 1,075, subject, "Avoiding the Beaten Path," I enclose clipping from Hartford *Courant*, concerning the relaying of broadcasts from WGY, through their Station WDAK. Results were fine.

"*The Courant* gave another evidence of public service yesterday evening through WDAK, its broadcasting station, by conducting the interesting experiment of relaying the address of Guglielmo Marconi, the inventor of the wireless, which it received from the General Electric Company's station, WGY, and enabling thousands of amateurs of the radio in Connecticut to hear Marconi. These amateurs with small equipment would have been unable to pick up the address but for the fact that *The Courant* station relayed it to all."

L. H. FIELD,
Hartford, Conn.

CRYSTAL RECORD

Editor, RADIO NEWS:

Having read of the excellent galena records of Mr. Haseltine and Mr. Shanner, I have decided to send you my galena record.

Since the night of December 15th I have heard concerts and lectures from the following stations: WJZ, KDKA, WGY, WWJ, KYW, WCK, WEB, and KSD. The last three mentioned are in St. Louis, Mo., which is about 110 miles from my home (and I thank my lucky star that my home is in the country where it is quiet). The station KSD can be heard when the phones are 6″ from my head.

WJZ was only heard one night. This was due to freak weather conditions. As for the others, they can be heard on nights when the weather conditions are favorable.

Some Interesting Articles Appearing in "Practical Electrics"

A New Air Depolarizing Battery.

Experimental Photoelectricity.
By Raymond B. Wailes.

The Electric Arc in the Laboratory.

Electric Heat in Lens Making.

Electric Resonance.

Beginnings of the Telephone.

Electric Advertising.

Electric Fountains.

I have also heard two amateur phone stations, 9MC of Roodhouse, Ill., and 9ASL of Springfield, Ill.

I will pipe down now and let some other galena "ham" give his record.

LYNFORD REYNOLDS,
RR No. 5. Jacksonville, Ill.

BRICKBAT GLACÉ

Editor, RADIO NEWS:

I wish to commend Mr. Garrick on his timely criticism of broadcasting, in the June issue. I also want to take issue with the Editor's comment at the end of the article, which begins with the words, "Unfortunately for our old timers, the day has come when they will have to take a back seat, at least for a while." Since when are we old timers? Whom will we have to take a back seat for? Surely not for those innocents who talk of "globes" and "radios" and who ask such questions as, "How much music can I get from this condenser?" It has been said, "Give 'em time, they'll learn." But they won't learn. They are in radio for pleasure only and have no desire to learn. By what right can we be classed as old timers? Is not the number of true dyed-in-the-wool hams increasing daily?

Judging by some of the Editor's statements, I do not believe that he could ever have had the interest of the amateur really at heart. He says, "As far as the amateur is concerned, radio telegraphy is on the wane." Does he not realize that the broadcasting station is looked on as a joke and a nuisance by the true amateur? Almost every owner of a C. W. set, when he first gets his license, hooks up a phone. In a week or so the novelty wears off and the phone is discarded and the owner goes back to pounding brass. It is almost invariably so. Try and imagine 6ZZ, 5HK, 5ZA, or 4GL tolerating broadcasting or phone when it is at all possible to work that "2," "3," or "8." It is fellows of this type who have put amateur radio where it is and it's an insult and a disgrace to the whole fraternity to call the latest addition, the broadcasting misfits, amateurs.

I have sadly noticed the conversion of this paper and the others to broadcasting and wish to state that it is impossible for you to have made a greater mistake. Undoubtedly catering to the novice increases your circulation, but I believe that this circulation is only temporary. In a year or so the craze will have passed and RADIO NEWS will be stranded. It will not be possible to fall back on the amateur, as he will have lost faith; in most cases he has already lost it.

If broadcasting must be reviewed, why not put it in a separate section and give us amateurs some real "dope" such as Mr. Jone's article on C. W. transformers in the June issue? There is only one really technical radio magazine at the present time. Surely that isn't enough to supply the entire demand.

RAY HARDENBERGH,
Minneapolis, Minn.

(*In order to enlighten Mr. Hardenbergh let us state that an "old timer" is and has always been considered one of the "dyed-in-the-wool" radio amateurs, who has been in the game almost since the start; in other words, ONE WHO KNOWS. Unfortunately some of these individuals do not read the signs of the times. They have not as yet learned the lesson of the wire telegraph, at the time when the wire telephone got its start. If the history of the radio telegraph and the radio telephone is written fifty years hence, it will be similar to the wire telegraph and the wire telephone. Just as the wire telephone has not put out of business the wire telegraph, so will the radio telephone not destroy the radio telegraph. When, however, we stop to figure out how many people are using the wire telephone today, and how many the wire telegraph, it will be seen that as far as popularity is concerned, the wire telegraph is decidedly in the background. To everyone using the wire telegraph, over 2000 are using the wire telephone. It will be and is so in radio. There will always be the few elect who will use the radio telegraph, but the majority will be interested in the radio telephone. Only those who cannot read the signs of the times, as for instance our correspondent, will not only have to take a back seat temporarily but permanently.*

To sneer at the public and at the "broadcasting misfits" is not only shortsighted in the extreme, but stupid, and we are quite certain that there was a time when our correspondent asked just as foolish questions—or far more foolish ones—than do the novices who enter the field today. It is this intolerance in radio that has in the past given it a black eye. The trouble with the "old timers" is that they think themselves the elite of the art, but do nothing to make the art known to other disciples. Fortunately for the latter, this has now been taken out of the hands of the "old timers," and broadcast is the very vehicle that gives the novice his radio education.

That RADIO NEWS *caters to the novice, is a thing we are proud of and which makes our work more interesting. We are glad that we do not belong to that class of radio enthusiasts who sneer down the beginner.*

The circulation of the RADIO NEWS *is not*)

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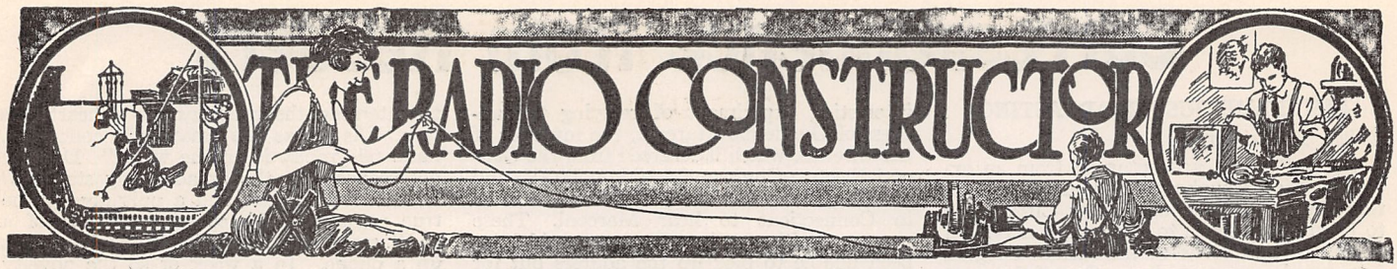
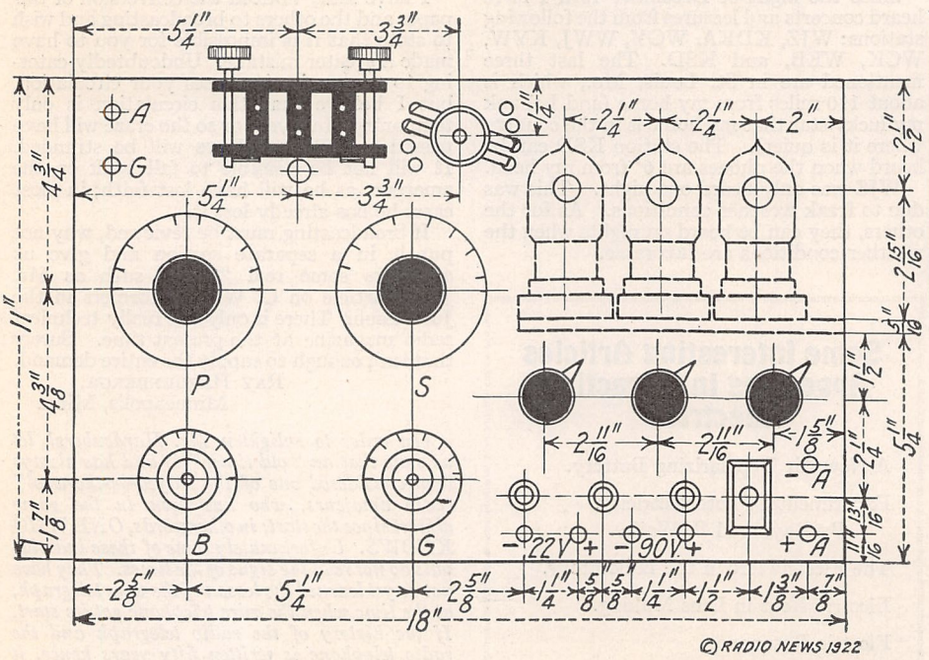
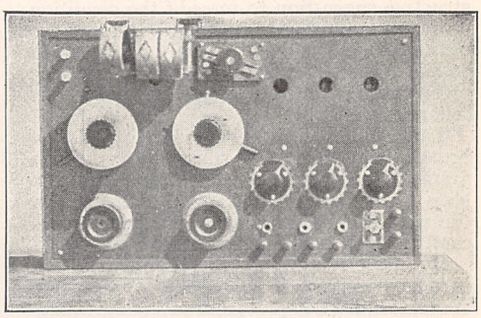


A Honeycomb Coil Receiver With Detector and Amplifier

By H. V. HOUYOUX





Above Is a Front View of the Completed Honeycomb Coil Receiver. On the Left Is a Plan of the Front Panel Showing Positions of All Holes to Be Drilled.

MUCH has been said against honeycomb or duo-lateral coil receivers as being inefficient, difficult to tune, etc. A letter was published some time ago in one of the radio magazines, stating that the best use to which honeycomb coils could be put was to bury them for a ground.

After considerable experimenting, extending over to almost a year with different receivers such as the vario-coupler and variometer types, single circuit tuners, etc., I finally decided to return to the honeycomb as being most efficient for all wave-lengths from 150 to 25,000 meters.

The receiver described below has been operated under all conditions and has proven exceptionally efficient, being less subject to static interference than any other tuner on the market. It has been found, on test, to be much superior both in electrical sensitiveness and mechanical adjustment to anything previously tried. Its ease and simplicity of operation and its extreme sensitiveness to slight variations of coupling, together with the great gains in signal strength resulting therefrom, should be greatly appreciated.

Owing to its sharp tuning qualities, local interference can be easily eliminated. In addition to its quality of causing the detector to oscillate on all wave-lengths with minimum manipulation of units, it is compactly built, small in size, considering the fact that every unit, including the two-stage amplifier, is contained in one cabinet and mounted on the same panel. The only external accessories being the "A" and "B" batteries, making the complete outfit easily portable.

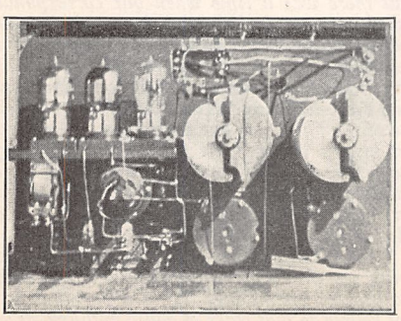
The location where this receiver is used is directly over an immense deposit of zinc and magnetic iron ore, which might or might not interfere with long range receiving. However, in view of this, among hundreds of C.W. and spark stations which have been copied from Europe, South America, Canada and on the Pacific coast, the following telephone broadcasting stations have come in QSA enough to entertain several hundred people assembled in our school auditorium: NOF, Anacostia, D. C.; WBZ, Springfield, Mass.; KYW, Chicago, Ill.; KDKA, Pittsburgh, Pa.; WGY, Schenectady, N. Y.; WMH, Cincinnati, Ohio; WWJ, Detroit, Mich.; 9XM, WHA, University of Wisconsin, Madison, Wis.; WOH, Indianapolis, Ind.; WBT, Southern Radio Corp., North Carolina; CKCE, Ontario, Canada.

It must be realized that some of these stations are more than 1,800 miles distant, which is quite a record for two stages of amplification.

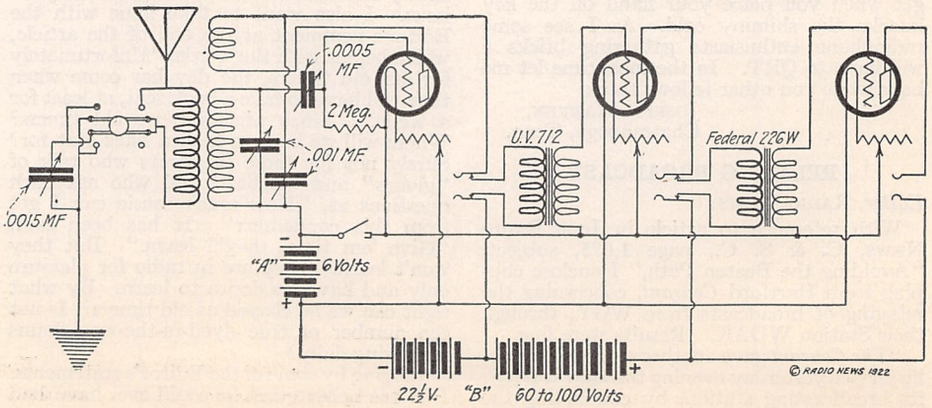
I wish to emphasize the fact that these stations were all received loudly enough to fill the school auditorium so no one had any difficulty in hearing and understanding.

Public demonstrations, to give the public a general idea of the possibilities of radiophone broadcasting, have been held, using a Magnavox in place of the phones. In these cases, 112 volts were used on the plates of

(*Continued on page* 494)



Above Is a Back View of the Completed Receiver With the Location of Apparatus Shown and to the Right Is the Wiring Diagram. Variable Grid and Phone Condensers Are Used on This Set.



A Real Lead Plate Battery

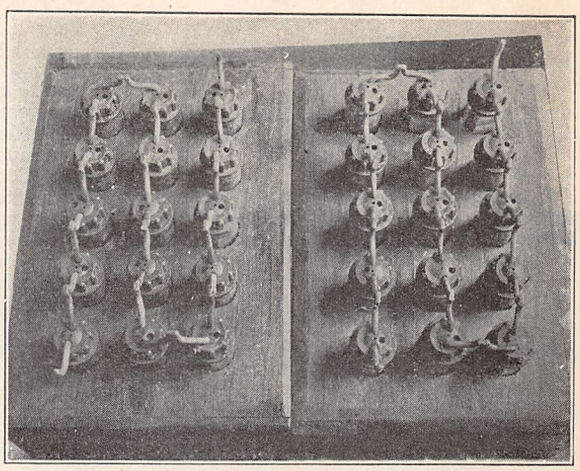
By GEORGE W. HALBERG

I have recently constructed a real lead plate battery which has given such excellent results as to repay me for the small amount of time and expense incurred. The battery to be described has 60 volts and approximately two ampere hours. Small glass tubes were secured, measuring 1¼" x 5" from a local glass house, at a cost of three cents each. They are much better than the ordinary test tubes because they have a thickness of about $\frac{5}{32}$", and will stand considerable rough handling.

I secured fourteen new standard battery plates, seven positive and seven negative, and cut them up into strips with a hack saw, care being taken to cut along the side of the plate ribs. With proper handling, four small plates may be obtained from a large plate. After all plates were cut up, several of the small ones were clamped together in a vise and filed down with a rasp to a width of ⅞". Separators were next cut up just a trifle wider than the plates and about ¼" longer.

In assembling, the grooved side of the separator is placed against the positive plate, which is brown in color. The next operation is to secure some kind of lug to be fastened on to the plates. It is best to get 3/16" round lead and cut it up into lengths of 3". One lug must be burned on to each plate. Those having access to a lead burning outfit may easily accomplish this, or the plates can be taken to a battery station where this will be done for a nominal charge. Soldering the lead to the plates will not do, as it will corrode within a short time and the connection will come loose. Next obtain some universal battery caps which can be had at a service station for about three cents each. Drill two 3/16" holes directly opposite each other for the lead connectors to come through. Another hole, ¼", may be drilled, also for filling purposes. Small rubber corks are used to plug these holes when the battery is in use. The cells are now ready for assembly. One positive and one negative plate, with a wood separator between, constitute an element and may be held together by wrapping two rubber bands around them. They are then fitted with a cap and the lead lugs are slipped through the holes drilled in the caps. Plates must not come all the way to the bottom of the glass cell, as some space must be allowed for the sediment which comes from the positive plate. The plates may come within ½" of the bottom.

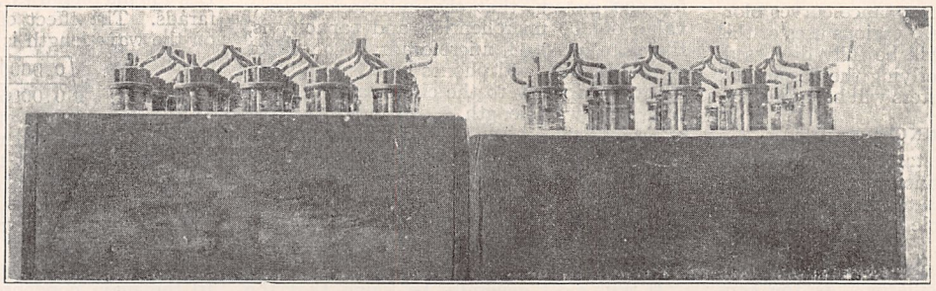
Heated sealing wax can be used in securing caps to the cells by pouring the wax around the cap and then pushing the latter down tightly. This makes it acid tight and prevents the acid from creeping. After all the cells are assembled, a box may be constructed to hold them. It is advisable to make one with holes, measuring about 1 3/16", drilled in the top to take the cells. This, of course, may be left to the builder's own ideas. When the box is completed and all the cells are in place, the connecting lugs are burned together or the ends of the lugs are flattened and holes drilled in them so a small bolt may be passed through. The cells are connected in series, each cell giving two volts. Sulphuric acid must now be put into the cells.



Top View of the Storage Lead Plate Battery Constructed by the Author of this Article.

It can be purchased at a battery station and is very cheap. The specific gravity of the acid should be about .1225. A weak acid is all that is necessary, and with its use the plates do not sulphate so easily from standing.

After the acid has been put in through the filling holes in the caps, the battery is ready for charging. When D. C. is available, this is a simple matter. By connecting the battery across the line in series with a 16 C. P. carbon lamp, enough current for charging is allowed to pass. In case of A. C. an electrolytic rectifier can be made cheaply to take care of the charging. The state of charging is determined either with a volt meter or by gassing. A battery of this kind needs little attention, it may be charged about once a month and distilled water added frequently to keep the acid level slightly above the plates.



Side View of the Storage Plate Battery. This Battery was Inexpensive and was not Difficult to Construct.

A Method of Cutting Out Interference

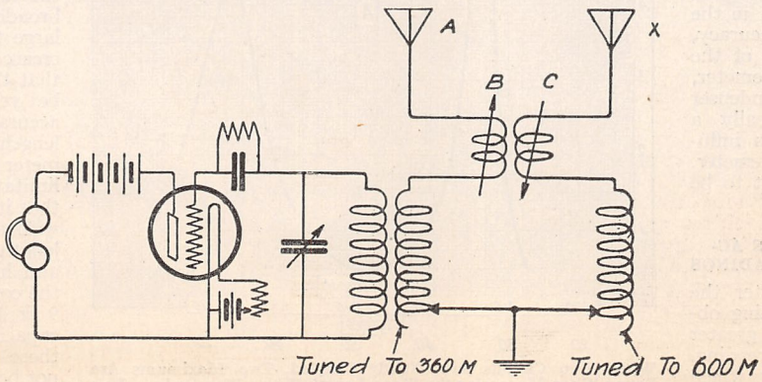
By V. A. BROWN

MOST of us have had the experience of tuning in the music on 360 meters, and just as we settle down to enjoy it, BANG—some commercial station on 600 meters jams in and drowns out the music. The commercial station must "work," as the business of the sea is more important than the broadcast, therefore it is up to us to balance out or cut out this interference ourselves.

This is accomplished by stringing up another antenna. It need only be a single wire of the necessary length, etc., so as to pick up the interfering station.

Refer to the diagram. Antenna A is the regular receiving antenna, and in series with it is a coil of only a few turns of wire, B thence to the regular receiving set. This antenna system is tuned to 360 meters.

The antenna marked X is our balancing antenna, and in series with it is a coil having only a few turns of wire similar to the small coil in series with the regular receiving antenna, *but wound in an opposite direction* to the first mentioned coil. The coil Y is simply an added inductance to enable the balancing antenna to be tuned to the interfering station (600 meters).



Here Is a Method of Tuning Out Interference from Broad 600 Meter Spark Station.

Couple the coils B and C together so that their fields are opposed, then the interference picked up on the regular antenna system will balance against and be neutralized by the signal picked up on the balancing antenna, which is tuned to the interfering station (600 meters).

The coupling between B and C must be adjusted carefully, but once adjusted it is permanent.

Be sure the fields set up by coils B and C are opposed, otherwise the interfering station will be strengthened instead of eliminated.

Also be sure the balancing antenna X is tuned to the interfering station (600 meters), otherwise you may be trying to balance against itself the station you wish to receive.

There is enough difference in wave-length between 360 and 600 meters to allow this balance to work perfectly, without losing signal strength on 360 meters.

Design, Construction and Uses of the Wavemeter

By M. WOLF

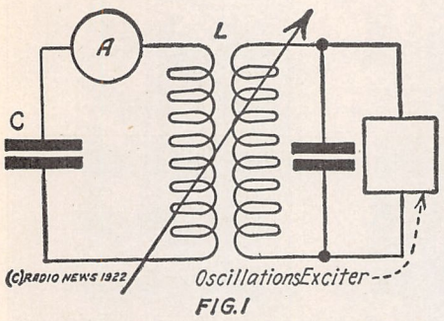


FIG. 1

This Diagram Shows How a Wavemeter Is Coupled to a Transmitter to Measure the Wave-Length Emitted.

OF all the measuring instruments employed in radio science the wavemeter is the most fundamental. From the name of the instrument the uninitiated might think it is designed to measure wave-lengths solely, but as this paper will show, there is hardly a measurement or test in radio in which its services cannot be utilized. It will measure wave-lengths, decrements, capacities, inductances, coupling coefficients. It will act as a detector of radio oscillations, it may be used as a source for the production of radio frequency oscillations of any desired frequency, and it may be used to obtain information as to the character and nature of oscillations by means of resonance curves plotted with its help. These various uses of this "utility" instrument will be fully discussed, and the principles underlying the design and construction of wavemeters will be taken up.

BASIC PRINCIPLE

It might be best to start with a brief discussion of the basic principle underlying the use of the wavemeter in all its various applications. This principle is the so-called "Resonance Principle." Suppose we have two radio circuits coupled together, Fig. 1, circuit 1 being an oscillator. As the condenser in circuit 2 is varied, the indication of the ammeter will likewise vary and at a certain setting will be a maximum. At this setting the two circuits are in resonance and their wave-lengths are identical. Thus if the true values of C and L were known in circuit 2, we could calculate the frequency and also the wave-length from the fundamental relation

$$\text{frequency } f = \frac{1}{2\pi\sqrt{LC}}$$

Consequently circuit 2 could be used as a wavemeter, and instead of calibrating the condenser scale with degrees it would be calibrated with the corresponding wave-lengths at each degree.

The important consideration in the use of the wavemeter is its accuracy, and therefore a consideration of the design principles of the wavemeter, excluding the calculation of condenser and inductance values, is really a consideration of those factors influencing the accuracy of the wavemeter. This, therefore, will be the next to be discussed.

FACTORS INFLUENCING THE ACCURACY OF WAVEMETER READINGS

In the first place, the greater the sharpness of the resonance setting obtained as explained above, the greater will be the accuracy of the reading. There are two important factors which increase the sharpness of tuning, and these are first, a very low damping factor for the wavemeter circuit, and second very loose coupling between the wavemeter circuit and the circuit whose wave-length is being measured. Consequently the instrument which indicates this deflection must be an extremely sensitive one which requires very little energy to operate it. This will permit of very loose coupling drawing an extremely small amount of energy from the measured circuit to operate it, and at the same time decrease the decrement of the wavemeter circuit since it consumes small energy. Another advantage of the very loose coupling between wavemeter and measured circuit is that there will be no interaction between these circuits and, therefore, no alteration of the emitted wave-length from the measured circuit. For sensitive detectors thermo-galvanometers are desirable, and where the oscillations to be measured have very small amplitudes, as in receiving sets, the best and most sensitive type of recording instrument to use consists of a detector and telephone receiver.

One of the factors apt to have considerable influence on the accuracy of the wavemeter is the indicating device mentioned in the previous paragraph. The extent of this influence depends upon the type of resonance indicator used and how it is used in the wavemeter circuit. Consider for a moment Fig. 2, which shows a simple wavemeter circuit using a detector and phones for indicating device. Assume that the wavemeter is set for 600 meters, that the inductance has a value of 300 microhenries, and capacity is, therefore, 0.00034 microfarads. The effect of the detector and phones here is to add an effective capacity to the circuit and thus increase the wave-length. This extra capacity effect introduced by the detector and phones is of the order of 0.000005 microfarads, which has the effect of altering the wave-length by about 4 per cent. It is, therefore, apparent that considerable care must be exercised in the design of the wavemeter in order to secure accuracy.

It will most generally be found that the particular effect which any indicator in a wavemeter has is a capacity effect, and, therefore, the larger the main capacity the smaller will be the influence of the indicator on the true wave-length. Consequently by designing the wavemeter R. F. circuit so that the capacity preponderates over the inductance the capacity effect of the resonance indicator may be decreased to the point where it is negligible and does not influence the accuracy of the wavemeter. The above actual numerical example will show this very clearly. At 600 meters the wavemeter inductance is 300 microhenries, the wavemeter capacity is, therefore, 0.00034 microfarads. A detector capacity of the order of 0.000005 microfarads alter the true wave-length by the square root of the ratio of the capacities since the wave-length is proportional to the square root of capacity, namely

$$\sqrt{\frac{0.000005}{0.00034}} = 4\%$$

Now suppose our wavemeter were designed so that the inductance was half the above value, and the capacity doubled to keep the wave-length the same. Then at 600 meters L is 150 microhenries, and C is 0.00068 microfarads. The effect of the detector capacity on the wave-length is now given by

$$\sqrt{\frac{0.000005}{0.00068}} = 2\%$$

And if these values of L and C were halved the effect would be reduced to 1 per cent. It is thus clear that the larger the main capacity is with respect to the side capacity of the indicator the less will be the influence of the indicator on the wave-length. Or, to put it in another way, by decreasing the detector capacity or increasing its reactance relative to the main condenser the less will be the effect on the wave-length.

The question now arises how high can the wavemeter capacity be made. It is obvious that it cannot be made too high else there will not be enough coupling inductance with which to pick up the oscillating energy. Apart from this there is one very good reason limiting this value of capacity which will now be made clear. This reason is the consideration of *sharpness of tuning*. The decrement of an R. F. circuit is given by the expression

$$\delta = \pi R\sqrt{\frac{C}{L}}$$

It is quite well known that the higher the decrement of an R. F. circuit the broader the tuning. If C is made very large the decrement of the circuit increases correspondingly, with the result that the tuning of the wavemeter will be very broad, resulting in an inaccurate determination of the wave-length. Practical experience in wavemeter designing points to very definite limitations of the capacity. It shows that it is not desirable or advantageous with a given coil to make the wave-length range greater than 3 or 4 to 1, and hence the maximum capacity of the condenser should not be more than 9 or 16 times the minimum. If the capacity of the condenser is kept within these limits, the above difficulty will not be encountered.

(*Continued on page* 482)

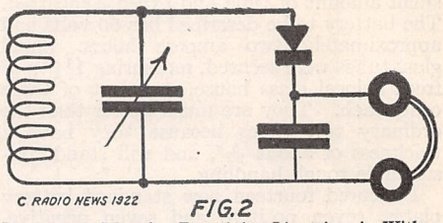
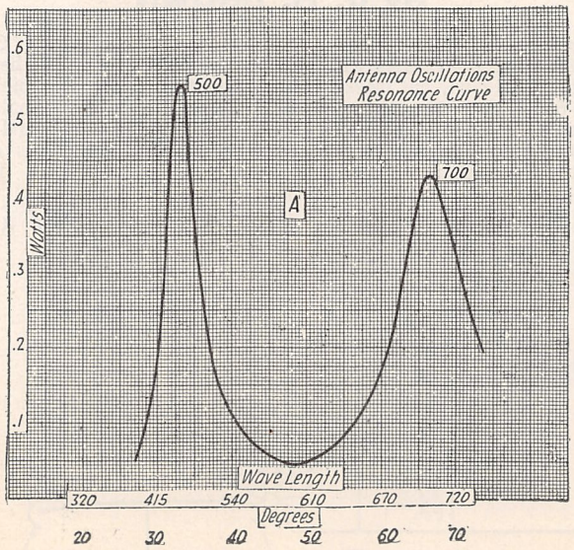


FIG. 2

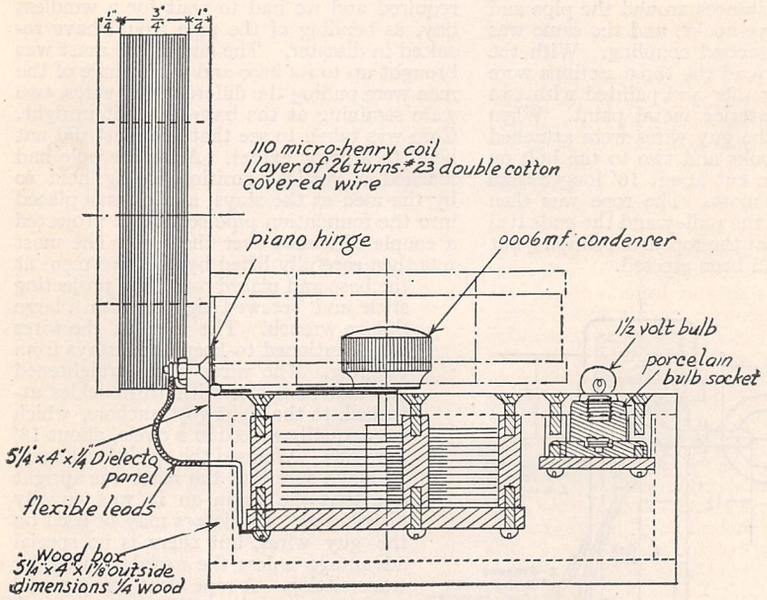
Resonance May be Found by Listening in With a Pair of Phones and Detector Connected to the Calibrated Circuit.



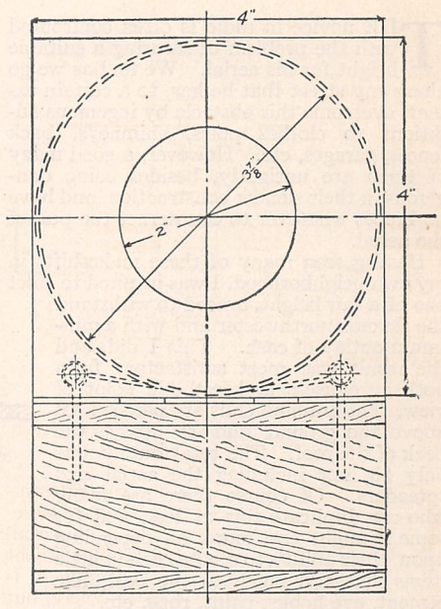
When Two Circuits Are Tightly Coupled, Two Maximums Are Found When Measuring the Wave-Length With a Wavemeter. This Is Due to the Reaction of the Circuits on Each Other.

A Miniature Wavemeter

By BERNARD STEINMETZ



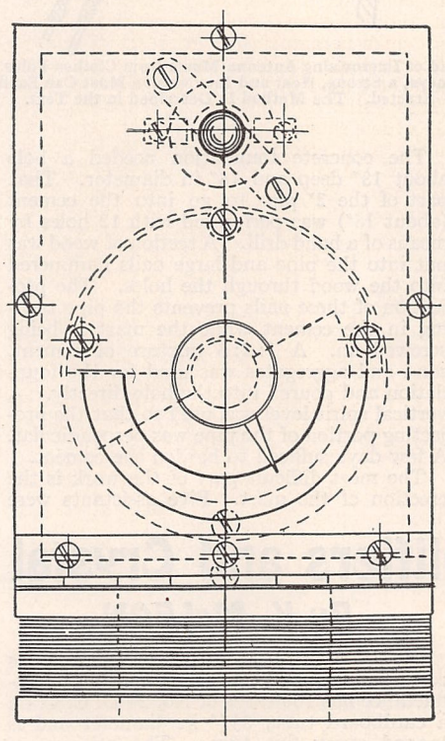
To the Left is a Cross-Section View, to the Right the Elevation and Below the Plan of the Wavemeter. Inductance is Wound in Cover.



THE wavemeter built for tuning a bulb transmitter is shown very clearly in the accompanying drawings, and is called a "miniature wavemeter" because of the extremely small size and the compactness of the outfit. The weight of the entire affair is negligible when one considers the weight of wavemeters in general, and the over-all size is such that the operator can carry it in the palm of his hand from point to point of his station, and tune with his other hand without any difficulty.

The over-all dimensions of the wavemeter box itself are 5¼"x4"x1¼", which is seen to be ridiculously small. The dimensions of the coil are 4"x4"x1¼". The wavemeter box is made of ¼" wood of the above dimensions, and is covered by a bakelite dilecto panel, also of ¼" stock. This panel need not be dilecto, of course, if this material is not available to the amateur. Formica, hardwood, or any other similar material will do just as well. Dilecto was used in this case.

The wavemeter consists of the wavemeter condenser, wavemeter coil, and small lamp, acting as indicating device. The condenser was made to cover approximately the range from 150 to 450 meters. The values of inductance and capacity in a wavemeter must be so chosen that the decrement of the wavemeter is a minimum and the tuning is sharp. The decrement of a wavemeter is directly proportional to the capacity and inversely proportional to the inductance.



Since a high capacity will result in high decrement and high inductance may also result in a high decrement, due to the increase in coil resistance, considerable care must be taken in choosing proper values. A good compromise must be made and for the range from 150 to 450 meters it was found that a maximum condenser capacity of about .0006 mfds. and an inductance of about 110 microhenries will give very good results, as far as low decrement and sharp tuning are concerned.

For a condenser a part of a Murdock variable condenser was used, the capacity of which was .0012 mfds. About half the plates were taken from this condenser, thus reducing its size and capacity to half, and this diminished condenser was used for the wavemeter condenser. It has the standard condenser handle and dial, as shown in the drawings. The condenser is set into the wavemeter box in the position shown in the sketches. To the right of it, on the top panel of the wavemeter box, is mounted the wavemeter resonance indicator, a small 1½-volt bulb. This is mounted in the standard porcelain bulb socket, which requires no description as it is well known.

The wavemeter coil was wound in order to have an inductance of 110 microhenries and was wound on a 4" square form, made of ¼" wood. The coil consists of one layer of 26 turns of No. 23 D.C.C. wire and contacts are made by means of two flexible

(*Continued on page* 496)

An Efficient Chopper for I.C.W.

By K. ROSS

AFTER listening to NZO, 3DH and 1XM with their chopped C.W., I decided that my 10-watt C.W. set would use I.C.W. for local work at least, because of the ease with which the receiving operator can tune the signals, and also because the tone was so distinctive and easy to read through QRM.

Not wishing to pay $7 or $8 for one of the tone wheels recently put on the market, I decided that a home-made one would fill the bill. My old rotary gap was not in use, so this was used in making the chopper. This gap consisted of a 1/6 H.P. motor and a disk of Murdock manufacture, one of the large size with round electrodes.

The first thing to be done was to cut off the points of the disk with a hack-saw, flush with the composition center. This left the disk slightly rough and one-sided. It was necessary to put it on a lathe and by holding a file against the edge, smooth it off and true it up at the same time. This made a disk that very closely resembled the one sold by the Radio Corporation, except that theirs has more segments.

This supposedly completed the disk and after mounting it on the motor, two brushes were made of thin sheet copper and mounted on the base so as to rub against the edge. The two brushes were connected in series with the grid leak and key.

The radiation from my set is two amperes on straight C.W., but when the chopper was first placed in operation in the grid circuit, the radiation fell from two amperes to .6 of an ampere. However, it was found that careful adjustment of the brushes to rub smoothly, increased the radiation to .9 of an ampere, and the tone was improved. All nearby stations, within 35 miles, reported the signals QSA and the tone fine. In an effort to increase the radiation still more, it was decided to eliminate one of the brushes from the edge of the disk.

In the center of these moulded disks there is a metal ring that supports the points of the

(*Continued on page* 496)

A Cheap Antenna Mast

By R. S. KENNEDY

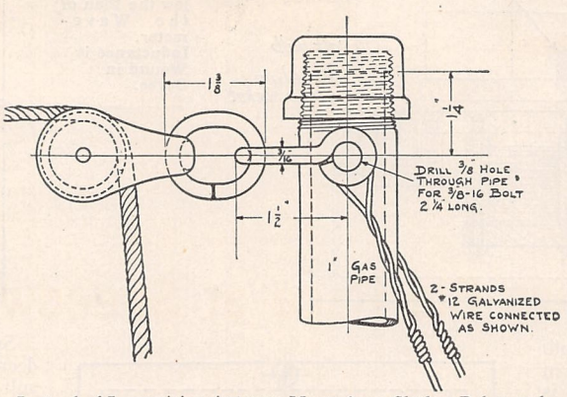
THE novice in radio is often confronted with the problem of securing a suitable height for his aerial. We find as we go along any street that he has, to a certain extent, overcome this obstacle by ingenious additions to clothes poles, chimneys, back fences, garages, etc. However, a good many of them are unsightly, besides being dangerous in their slender construction, and have no braces whatever to counteract the pull of the aerial.

Having seen many of these makeshifts in my own neighborhood, I was inspired to erect one of a fair height, braced to withstand the fiercest northwester and with a minimum outlay of cash. This I did, and the result was most satisfactory from both an efficient and æsthetic point of view. The antenna ends are perched 45′ above the ground and 15′ above the peak of the roof. The total outlay was only $8, not including the aerial and spreaders. Of course there are many who can duplicate this at less, and for some it might cost more, all depending upon their ability to secure certain little items that add much to the cost, like cement, eye hooks, paint, rope, etc.

First of all I visited a junk yard and selected four pieces of straight gas piping of the following lengths and sizes: 1″ pipe 8′ long, 1¼″ pipe 16′ long, 1½″ pipe 18′ long, 2″ pipe 2′ long.

Of course I saw to it that the pipes were threaded at both ends. Some of the threads were quite rusty, but I managed to finish them off very nicely with a three-cornered file, as no threading dies and stock were available. Next I placed the pipes on wooden horses and scraped off as much rust as possible with the edge of an old file and rubbed them with kerosene, after which I secured the following accessories at a local hardware store: Reducing couplings, cast iron, 1″x1¼″, 1¼″x1½″, 1½″x2″; two 1″ caps; 500′ of No. 12 B. & S. galvanized wire; one ⅜″ 16 bolt and nut, 2¼″ long; one small line pulley; 100′ of clothesline rope; six ¼-20 eyehooks.

The sketch shows the method of attaching the antenna to the end of the mast. The two pieces holding the pulley may be forged out of 3/16″ round iron rod. Just under the first coupling I drilled and tapped three holes at equal distances around the pipe and screwed in the eye-hooks, and the same was done under the second coupling. With the assistance of a friend the three sections were then screwed together and painted with two coats of good exterior metal paint. When this had dried, the guy wires were attached to the six eye-hooks and two to the bolt on the top and then cut about 10′ longer than the base of the mast. The rope was then inserted through the pulley and the ends tied in order to prevent the rope from slipping out after the pole had been erected.



Instead of Improvising Antenna Masts from Clothes Poles and Chimneys, a Strong, Neat and Inexpensive Mast Can Easily Be Erected. The Method Is Described in the Text.

The concrete foundation needed a hole about 18″ deep and 18″ in diameter. That part of the 2″ pipe to go into the cement (about 18″) was perforated with 12 holes by means of a hand drill. A section of wood was put into the pipe and large nails hammered into the wood through the holes. The projection of these nails prevents the pipe turning in the cement while the mast is being screwed on. A 1:2:3 mixture of cement, sand and aggregates was used for the foundation and poured into the hole directly. A vertical spirit level was used so that the projecting portion of the pipe was perpendicular. A few days sufficed to harden the cement.

The most difficult part of the work is the erection of the mast. Five assistants were required and we had to wait for a windless day, as bending of the pipe would have resulted in disaster. The end of the mast was brought up to its base and while three of the men were pulling the different guy wires, two were straining at the base to set it upright. Care was taken to see that the mast did not bend to a great extent. After the pole had reached a vertical position, being held so by the men at the stays, a stick was placed into the foundation pipe so that it projected a couple of inches over the top. The mast was then carefully lifted by the two men at the base and placed over this projecting stick and screwed tightly with a large Stilson wrench. The men at the wires were cautioned to keep their stays from tangling. The wires were straightened out and fastened, with turnbuckles attached, to the eight guy anchors, which were equally spaced in a circle, about 18′ in radius. We used the spirit level again to make sure that the mast was upright and that the strain on it was equally distributed. Insulators may be used on the guy wires, but there is no special advantage unless the aerial is used for transmitting. A rope cleat was screwed on to the mast, about 5′ from the ground.

For the other end of the aerial, which was on a sloping roof, we screwed a 15′ section of 1″ pipe into a large cast-iron flange, which was bolted to a block of wood, cut at an angle. This in turn was nailed to the shingles. The top of this pipe had the same method of attachment for the antenna as the other mast, as shown in the sketch. The poles were then ready to receive the spreaders and the aerial wire.

For those who cannot secure piping in such long lengths, I would advise the use of a 2½″ section for the foundation and four more sections to complete the mast and four reducing couplings to connect them. An ideal mast of 45′ in five sections would be of the following lengths and sizes: 2′ of 2½″ pipe, 14′ of 2″ pipe, 12′ of 1½″ pipe, 10′ of 1¼″ pipe, 8′ of 1″ pipe.

The top section should always be the shortest piece and have three guys from under each coupling and two from the top end to counteract the strain of the antenna.

R. F. Amplifiers and Crystal Detectors

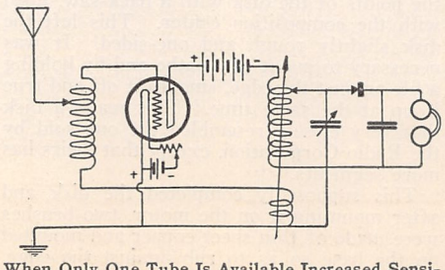
By K. McLEAN

WE have lately been reading a great deal about radio frequency amplification and its advantages, and I am sure I am not the only "ham" who has to be satisfied with the reading, owing to the difficulty in persuading the radio dealer to extend credit for an indefinite period, and the impossibility of collecting the necessary coin for the purchase of a number of V.T.'s, batteries and other incidental apparatus.

Having started radio with a home-made crystal tuner and later reconstructed it as a single valve set, I thought it would not be a bad plan to have both the V. T. and the crystal detector working together and thus make the most of what I had.

There is nothing new about the circuit and I am not going to describe the construction of each part in detail, the idea being to use what you have as far as possible. A single slide tuner, loose coupler or variocoupler, and a .0005 m. f. variable condenser will take care of the tuning. On long waves honeycomb coils would doubtless work well in this circuit with the addition of a variable condenser in the aerial circuit for tuning, since these coils have fixed values of inductance.

My set tunes to about 800 meters and has coils of the following sizes. The aerial inductance has 100 turns of No. 24 D. C. C. on a cardboard tube, 3¼″ in diameter and is tapped every five turns. The primary of the coupler, to which the crystal circuit is connected, is 105 turns of No. 24 D. C. C. on a 4¾″ tube, tapped every fifteen turns, and the other coil, which is connected in the aerial circuit and provides feed-back between the grid and plate of the V. T., is 3½″ in diameter and has forty-five turns of the same wire, but is not tapped.



When Only One Tube Is Available Increased Sensitivity Can be Obtained by Using It as a Radio Frequency Amplifier with Crystal Detector.

Be sure to adjust the detector to its most sensitive condition, as the degree of amplification obtained depends principally upon the detector. I use radiocite, which I find more sensitive than galena. If you hear a terrible howling in the phones that will not stop, you may be sure your detector is out of adjustment. With fairly tight coupling between the grid and plate coils adjust the detector carefully when the signals are coming in, and the results will surprise you.

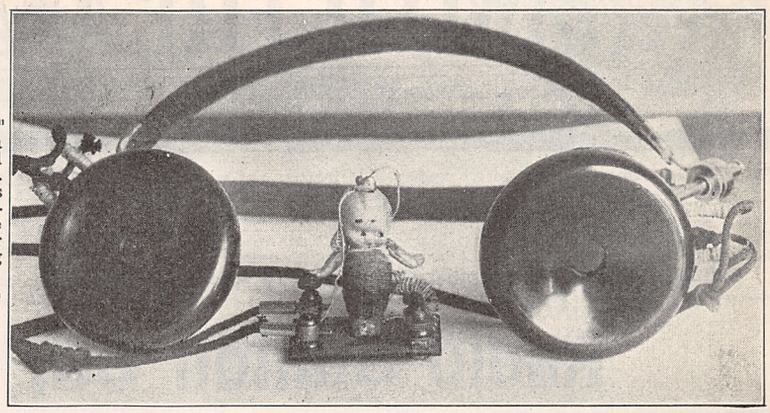
When I used the V. T. only, with standard tickler coil hook-up, I could just hear VNC (Capetown, South Africa), which is about twenty-five miles away, with the phones lying on the table if I sat next to them. With the circuit here described and by careful adjustment of the detector, I can easily hear him anywhere in the room—and that is up to 10′ from the phones.

A BETTER METHOD OF WINDING HONEYCOMB COILS

Having experimented with various systems of winding honeycomb coils as described by the RADIO NEWS, I hit upon the following method which will produce a coil exactly the same as the machine wound type.

(*Continued on page* 540)

An Amateur's Novel Set



Kewpie Has a New Dress All Made of Wire. The New Hat is a Crystal Detector. Kewpie and Her Owner Are Listening In.

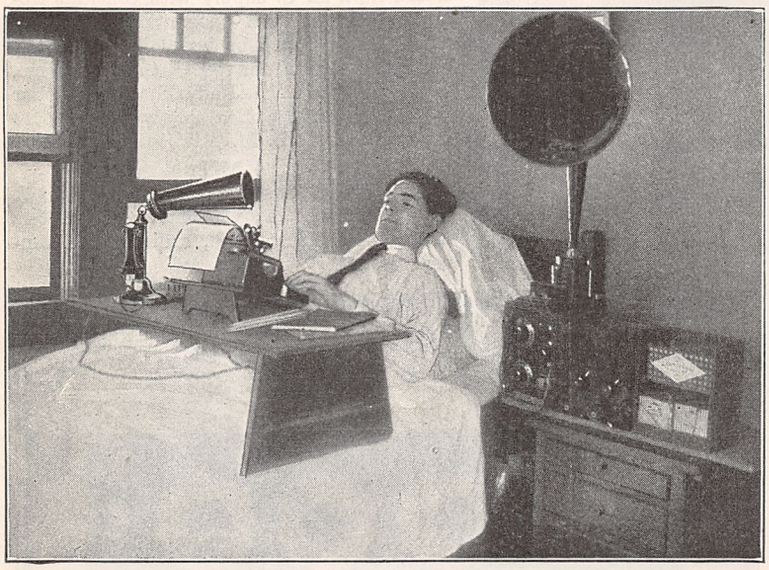
A LITTLE Kewpie, tightly wrapped with No. 30 gauge, D. C. C. wire, a crown on its head serving as a crystal detector, a pair of binding posts, a head set and a young inventive genius, have all been used by William Tecklenburg, fourteen years of age, in the making of a complete radio-receiving set He "listens-in" on all of the big Denver stations, which are situated near where he lives, and the little Kewpie gracefully syncopates as the music is pulled from the ether by the novel instrument.

"I guess that, with everything included, it cost about 25 cents, or maybe 30 cents. If I had bought both binding posts it would have cost 30 cents anyhow, but old battery posts are just as good," explained the young enthusiast. It took William almost all of 25 minutes to make the set.

Shut-In Follows Big Race at Speedway by Radio*

Because he is an invalid, A. J. DeLong, of Lafayette, Ind., could not attend the 500-mile automobile race at the Indianapolis speedway. He could not join the crowds at the gates, brave the hot sun, and smile at the dust. Nevertheless he attended the race—by radio.

Like most young men, DeLong is interested in sports. Each year he has waited patiently for the information, or phoned a newspaper office for some word about the progress or result of the contest. This year it was different. All that he had to do was to reach out and put his radio set in operation, and the voices of those who announced the official bulletins were audible all over his room. He did not need to wear a head-set as he has his receiving outfit equipped with a Magnavox, which makes the sounds so loud that music is often heard a block away.



Mr. DeLong Is An Industrious Invalid. He Runs a Business and Writes For Magazines, and Is Well Acquainted With Radio.

At ten o'clock he heard the bomb explode that started the race drivers on their way. He also heard the roar of the engines as the drivers pulled away for the long grind. During the race he knew as much about the positions of the drivers as the man who had his straw hat pushed in by the fellow behind him. At regular intervals the two broadcasting stations at Indianapolis sent out bulletins and information regarding the progress of the contest. This voice came in as loud as if the announcer had been standing in DeLong's room.

A radio set is an interesting invention to all who are acquainted with its operation, but it is the more precious to DeLong because of his physical condition.

DeLong makes his living by taking subscriptions to magazines. He has a host of friends. Everybody in Lafayette knew that he was getting first-hand information about the races. His place of business was crowded with those who were eager to get some word about the contest. Both his telephones rang incessantly, and he and his assistants put in the biggest day's work they have done for some time.

*The Indianapolis *News*.

Improving Reception With Westinghouse Tuner

By ROY A. ANDERSON

Some time ago I was experimenting with the Westinghouse tuner, using two steps of amplification, and I found that with the type of aerial I was using I was unable to get the set to oscillate sufficiently on the particular wave-lengths which I desired to reach—namely, the broadcasting and amateur waves, 360 and 200 meters respectively.

I might say, however, that this difficulty was not experienced with a 40′ single-wire aerial, the trouble only being encountered when I attempted to use a 225′ single wire. My reason for desiring the latter was that I believed it would increase the signal strength, which it eventually did.

To get back to the subject, I decided that if it were possible to change the hook-up I would not have to go out in the rain and "monkey" with the aerial.

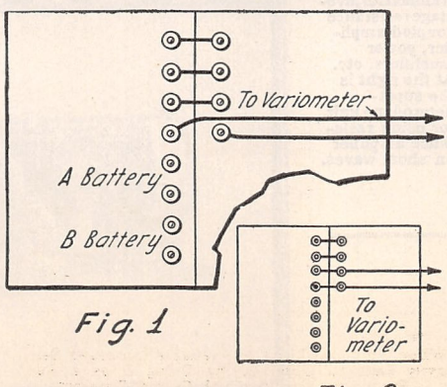


Fig. 1

Fig. 2

Having a couple of VARIOMETERS handy, I put one of them in the grid circuit, but, although this worked fairly well, I tried a change for increased efficiency and found that by putting the variometer in the plate circuit instead I was able to get down to consiederably below the broadcasting wave-length.

If a Variometer Is Connected to a Westinghouse Tuner in This Manner, Better Control Is Obtained of Regeneration.

To the beginner this will not illustrate that which he may need for increased efficiency, but it will illustrate an important fact, i. e., the *value of experimentation.*

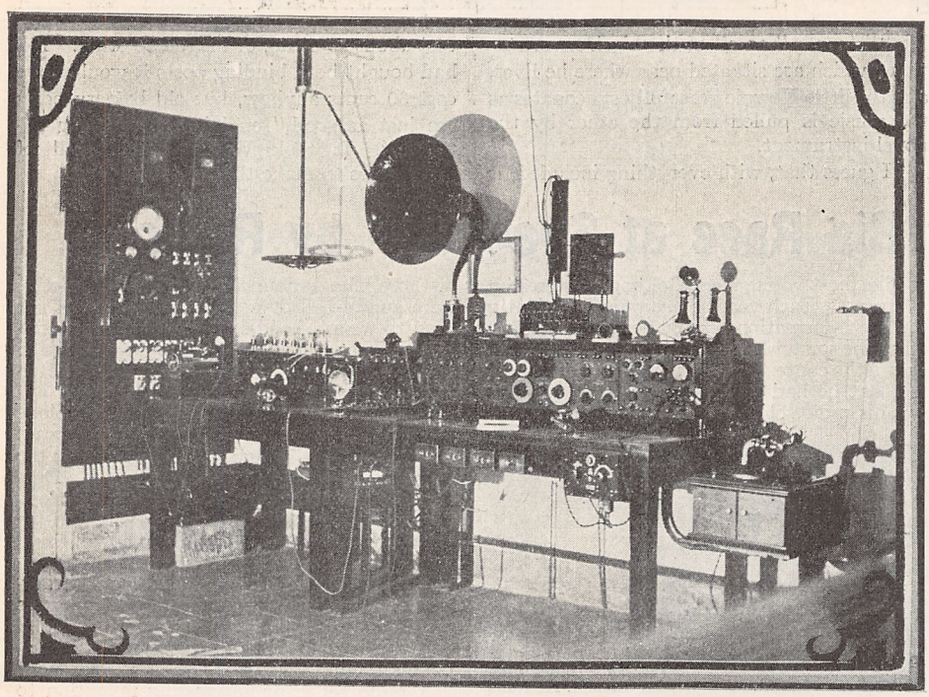
Rather than insert "complicated" hook ups to puzzle the beginner, sketches are used

THIS Department is open to all readers. It matters not whether subscribers or not. All photos are judged for best arrangement and efficiency of the apparatus, neatness of connections and general appearance. In order to increase the interest in this department, we make it a rule not to publish photographs of stations unaccompanied by a picture of the owner.

We prefer dark photos to light ones. The prize winning pictures must be on prints not smaller than 5 x 7". We cannot reproduce pictures smaller than 3½ x 3½". All pictures must bear name and address written in ink on the back. A letter of not less than 100 words giving full description of the station, aerial equipment, etc., must accompany the pictures.

PRIZES: One first monthly prize of $5.00 All other pictures published will be paid for at the rate of $2.00.

Radio Station CG, Havana, Cuba



I send herewith a description of Radio Station CG.

The antenna used is of six No. 20 seven-strand phosphor bronze wires, of which the total length is 85′ and its height is 45′. The spreaders are 18′ long and the wires are 3′ apart. The antenna used is type "T."

The ground used is a counterpoise insulated, is 9′ above the roof, and uses the same amount of wire as the antenna.

My transmitter is of 15-watt C. W. and I. C. W., using 5 watts Western Electric V.T.-2. Type O T 3, Midget Radiophone. The current is supplied by a motor generator set, the motor being a ¾ H. P. 110-volt A. C., which gives a voltage of 600. Two 4-button microphones are used, one transmitter tone-arm, and the other hand transmitter made by the Magnavox.

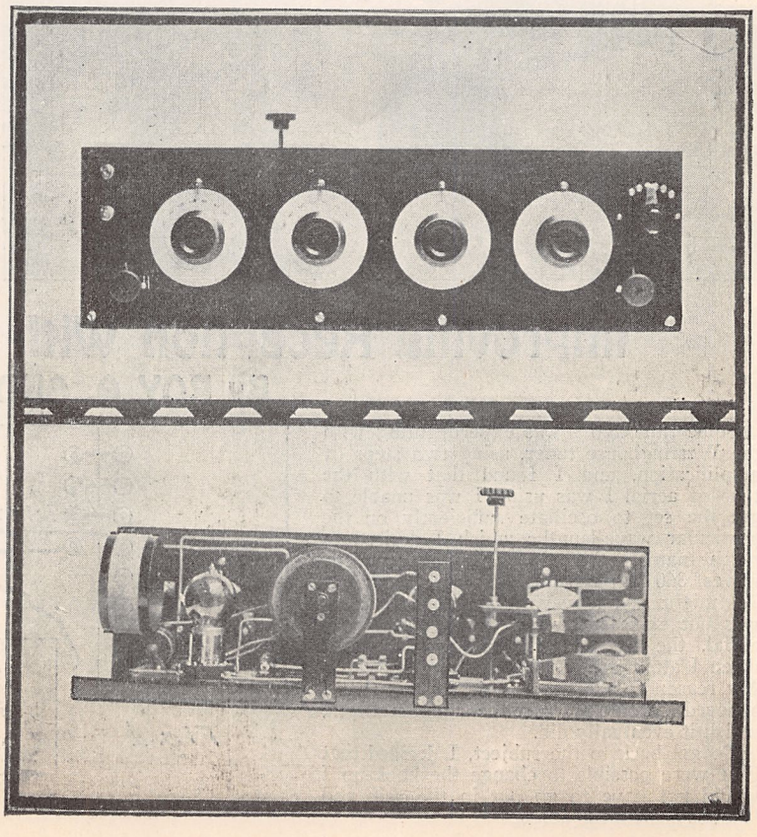
My receiving set comprises a long-wave and short-wave tuner, a detector and three-stage amplifier and wave-lengths from 150 to 25,000 meters can be covered. There are four tubes of Western Electric V.T.-1. I use a New Magnavox power amplifier type A.C.-3, model C of 3 steps, with three Western Electric V.T.-2's, with 300 volts on the plate, D. C. To work with large station I have five steps of radio frequency, one detector and two of audio with a loop antenna, which work from 6,000 meters on. I have the automatic phonograph recorder for the reception at high speed, and to record the broadcasting stations of radiophones of the U. S. A., such as WJZ, Newark, N. J., KDKA Westinghouse Electric Mfg., Pittsburgh, Pa., WDY Radio Corp. of America, Roselle Park, N. J., WGY General Electric Co., Schenectady, and many others that have been heard a block from here using the three steps of power amplification. I have sent, with my transmitter, as far as Caibarien and Cienfuegos, which are about 200 miles away.

This has been the first broadcasting station in Havana, Cuba, which has been working most every night for the last year to see if I could increase the interest here, and I think I have done so, because there are quite a number of my friends who now have sets.

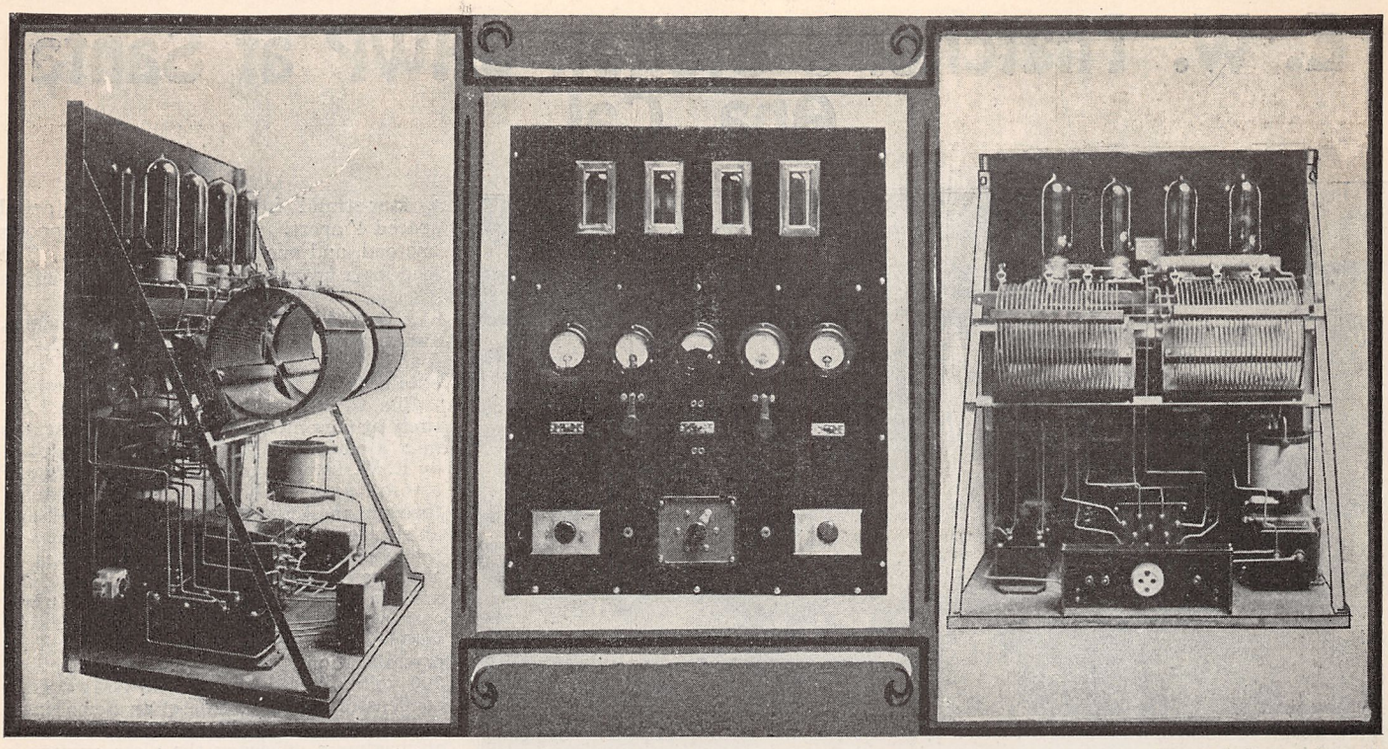
I have just finished a 100-watt radio telephone and telegraph, using full wave rectification from A. C. supply with constant frequency circuit and magnetic modulator, which I expect will be heard in the States. If any amateur from the U. S. A. gets me, kindly address C. G. Radio Station Escobar No. 65, Havana, Cuba. My working hours are from 9 to 11 P. M.

4 MN

Radio 4MN has been assigned to J. V. Settle, Winder, Ga., who has two 5-watters Acme 200 rectified A.C., radiation 1.6 amperes.



They do other things well besides tourists in Cuba. Above is a view of an up-to-date amateur station with everything imaginable—phone, C.W. transmitter, five-stage resistance coupled amplifier, power amplifiers, etc. At the right is the super-heterodyne unit for using resistance amplifier on short waves.



Here are Three Views of the Transmitter. This Cuban Station Has a Regular Broadcasting Schedule. The 200 Watt Transmitter Is Self-rectifying and a Magnetic Modulator In the Aerial Circuit Is Employed for Phone Transmission.

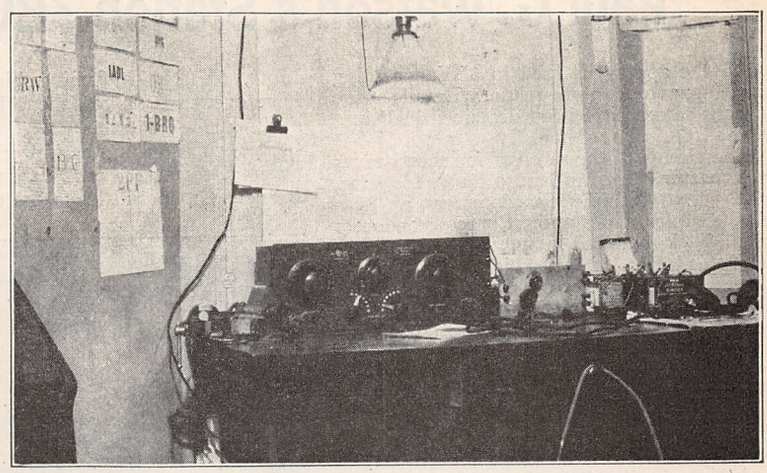
David Talley's Station 2PF

Am enclosing you two photographs of 2PF for publication in RADIO NEWS. The following is description of same:

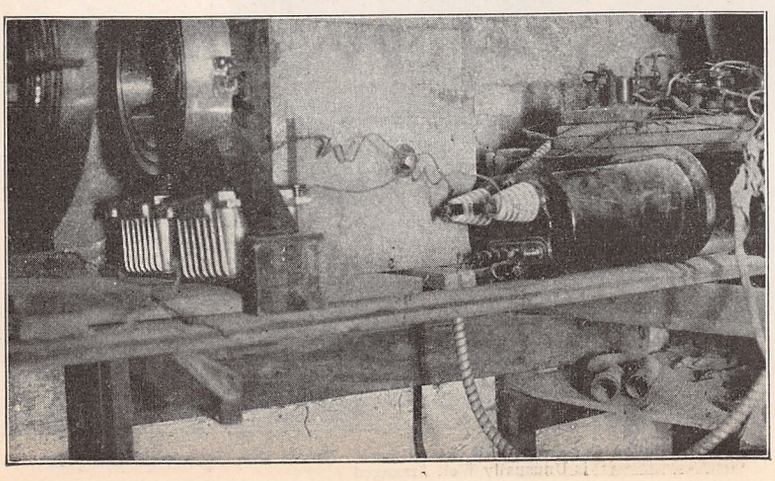
Receiver.—Latest model GREBE CR-3 short wave regenerative receiver with audiotron detector and two-step amplifier (not shown in photo) and a pair of Western Electric phones. A single wire antenna, 100′ long and 45′ high, is used. The music from WJZ and other broadcasting stations can be heard all over the house and in the street from the loud speaker. On the table may be seen the push buttons controlling the relays operating the transmitter in the cellar. One button starts the Synchronous motor and the other acts as switch for high or low power and the keys on table control the relay key in the cellar. Signals from every district have been heard as well as commercial and ship stations all over the world.

Transmitter.—½-K.W. Packard transformer, two .004 mfds Dubilier condensers, 120-cycle synchronous spark gap enclosed in the wooden box and heavy pancake O.T. Radiation is 2.5 thermo-coupled amperes. Antenna is 4-wire inverted L, 35′ long and 60′ and 45′ high from pole on the house to a tree. A 4-wire cage lead-in is taken from lower end. Have cards all over room from every district except 6th and 7th and handle traffic for the A. R. R. L. regularly with 1st, 2d, 3d, and 8th districts. Have been heard by ships 300 miles off Florida, and in the English Channel during the recent trans-Atlantic tests. We belong to the American Radio Relay League, and also to the Radio Club of Brooklyn affiliated with the A. R. R. L. A 10-watt C.W. set will be installed this summer, but the old spark will always stay. The operators' signs are D.T., D.S.

DAVID TALLEY.



The receiving station at 2PF. A long single wire is used for an antenna. The push buttons operate relays to the transmitter in the cellar.



Remarkable long distance records have been obtained with this ½ K. W. synchronous spark transmitter.

GOOD WORK FOR A 5-WATTER

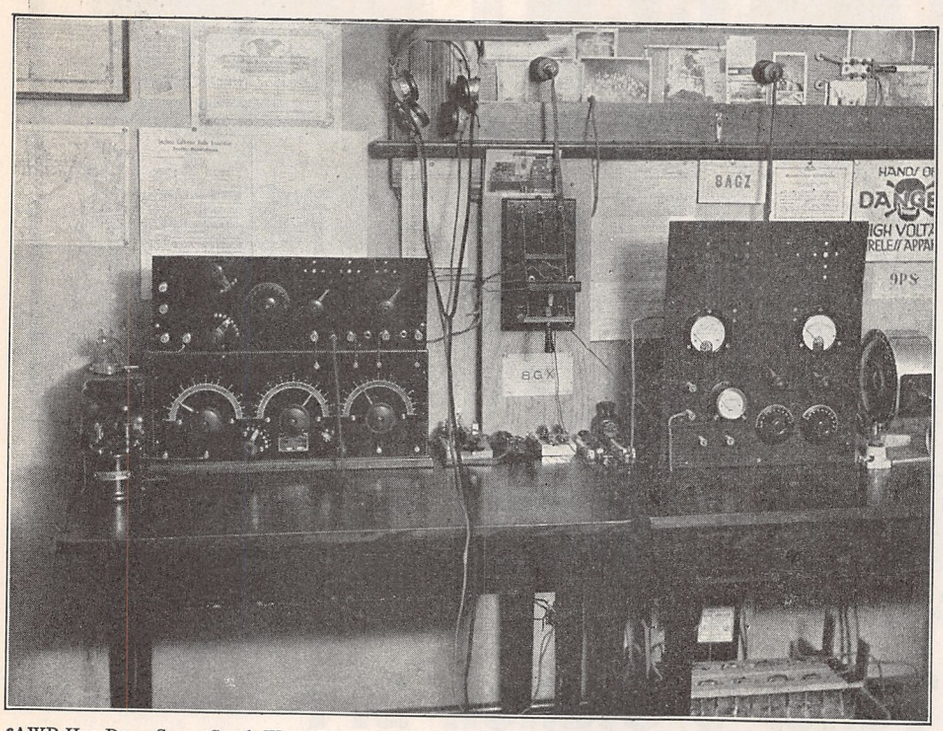
2BEK, using 90 volts on the plate of a 5-watt tube, has been logged at 9IN several times. 9IN is about 1,000 miles from Manasquan, where 2BEK is located. This is not the only DX reported of 2BEK, as he has been logged by a number of distant stations. Wonder what's going to be the next? Guess to Russia on a Myer's tube with 22½ volts on the plate.

CORRECTION

Please announce in the RADIO NEWS that contrary to the last call book the call 8KI has been issued to Ellis Merry, 268 Auburn Avenue, Pontiac, Mich. Any report on the C.W. signals of 8KI will be appreciated.

ELLIS MERRY.

E. W. Thatcher's Station 6AWP at Santa Ana, Cal.



6AWP Has Done Some Good Work With the 10 Watt C. W. Transmitter Seen at the Right. He Uses an Electrolytic Rectifier

RADIO 6AWP is owned and operated by Everett W. Thatcher, whose station, 8GX, appeared in RADIO NEWS a year ago. The station is located at 407 West 1st Street, Santa Ana, Cal.

The antenna system at 6AWP consists of a four-strand inverted "L" type aerial spaced 4′ apart. A mast, 75′ high, supports one end, and one 50′ high, the other. The lead-in is brought down in the form of an 8″ cage.

A counterpoise, duplicate of the antenna, and directly beneath it at a height of 12′, is found to give much better results than those obtained with the usual earth-ground system.

The C.W. transmitter, which is used entirely at present, consists of two 5-watt tubes in a Modified Hartley Circuit. (Described by E. W. Dannals in the June, 1920, issue of RADIO NEWS.) The high voltage is obtained through an Acme 200-watt transformer and an electrolytic rectifier, which makes use of the popular lead and aluminum plates in a saturated borax solution. Ten such jars are used, as shown in the lower right corner of the picture, and no trouble has yet been experienced in overheating or crystallization. This system delivers about 500 volts, filtered through two 1-MFD filter condensers on either side of an Acme single coil choke. When the tubes are oscillating at maximum efficiency the plate current is 95–100 milliamperes, and the radiation is 1.7 amperes on 200 meters.

The receiver is a Z-Nith Regenerator with a two-stage audio frequency amplifier and Western Electric phones.

6AWP has been frequently heard over 2,000 miles. Reports are at hand from Cleveland, O.; Key West, Fla.; Yukatat, Alaska; and Wailuku, T. H. Consistent work is carried on with stations up to 1,500 miles distant. Through regular schedules a great many messages have been handled during the past season.

Paul G. Watson's Station 3BV at West Chester, Pa.

All the apparatus used in 3BV, excepting the Magnavox, is home-made. Details of the various pieces have been described in RADIO NEWS from time to time.

The circuit of the receiver for short waves was that described in RADIO NEWS for June, 1922. Two "Simplex" variometers, a "Simplex" coupler, a .001 mfd. "Cotoco" condenser and a back-mounted inductance switch compose this tuner. A switch is arranged on the short wave condenser in such a manner that the condenser is automatically short circuited at a point just beyond the 180 adjustment. By using a back mounted primary switch, heavier construction can be used, and as a result a much quieter switch action.

The long wave tuner was described in detail in RADIO NEWS for May, 1921. It consists of the coil mount, two condensers, and the series parallel switch for the primary circuit. The "ticker" or "feed-back" circuit is employed in this tuner.

These two tuners are connected to the audion cabinet, described in RADIO NEWS for December, 1921, by a three-pole double throw switch, eliminating all dead end effect.

The amplifier described in the July, 1922, issue is wired according to the circuit given out by the Federal Tel. & Tel. Co. of Buffalo, N. Y., using "Acme A-2" transformers.

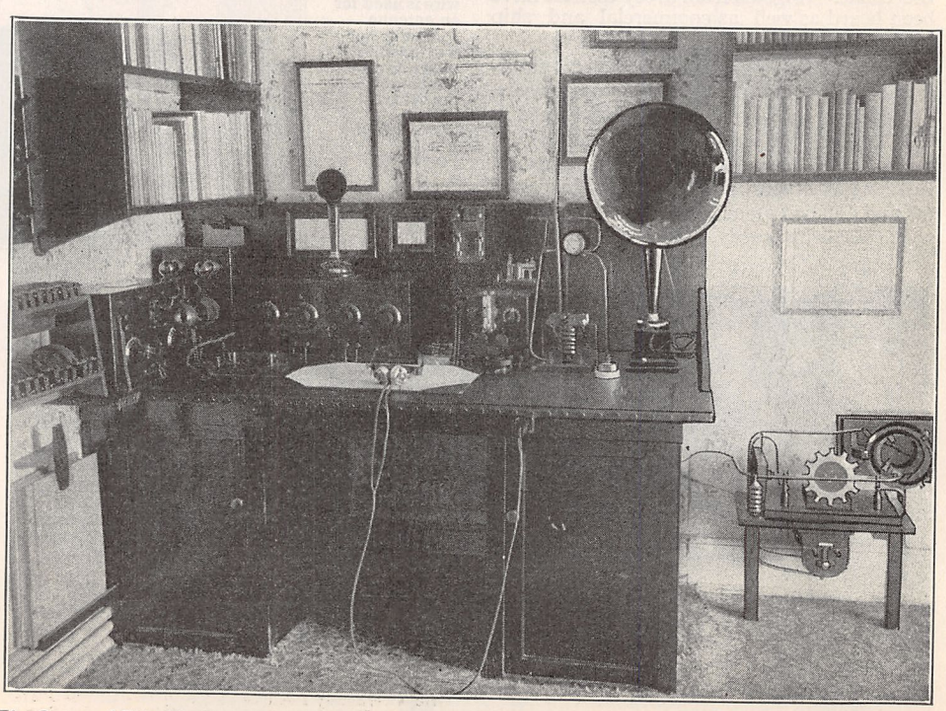
A Magnavox, Radio type "R3," completes the receiving set, excepting phones, which are Brandes Navy type.

Unfortunately the transmitter is without A. C., so I am forced to use a coil until such power is again available. However, with this small transmitter I have worked 44 miles, to 3CC after tuning the set closely. Some of the 1 KW. sparks take notice.

On the night of June 1, 1922, I heard some DX worth noting. 6XAD, 6ZK and 5ZA all in one night. I have a letter from Major Mott, 6XAD, confirming his signals, and have every reason to believe I will later get a similar letter from 6ZK. 5ZA comes in fairly regular during the winter months. The other stations heard on CW. are too numerous to mention, so will leave the entire list out.

On the long wave tuner, most of the high power European and American arcs have been heard, and several times I have been able to hear NPO at Cavite, Philippine Islands.

PAUL G. WATSON,
Member Radio Club of America and A.I.R.E.



The Owner of This Handsome Station Constructed All of it Himself—Except the Magnavox. The Apparatus is Unusually Well Arranged

The Vacuum Tube as a Detector

By STANLEY EDGAR

THE vacuum tube used in radio is rapidly becoming almost as familiar an article in the household as the electric light bulb. Radio receivers are installed in thousands of homes and nearly all of them employ vacuum tubes or audions. They are so perfected to-day that the novice can operate a set even although his knowledge be limited to the understanding that reception is effected by "switching on the lights and turning round the dial."

The audion somewhat resembles the ordinary light bulb, but is much smaller. On examination it will be found that there are several important differences. Two elements, in addition to the filament, are included in the audion. These two elements are known as the plate and grid and are illustrated in Fig. 1. This diagram also indicates the signs which are used in wiring diagrams to indicate the three elements of an audion. The size and distance between these elements varies in different types of tubes. The plate, in one type of tube, is a cylindrical piece of metal which encloses both the grid and the filament. The grid resembles a small spring, in the center of which is suspended the filament. The grid and plate are each brought out to little prongs on the base. The two

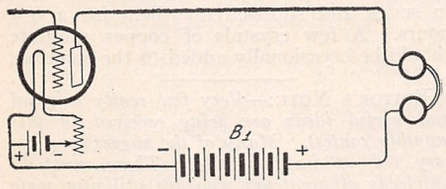


Fig. 2

The Space Surrounding the Filament of an Audion Will Conduct a Current in One Direction Only. When the Filament Is Lit, Current Will Flow in the Circuit of B2.

sides of the filament wire are also brought to two prongs. The three elements of the tube are enclosed in a glass envelope. Air is excluded from the space inside, producing a very high vacuum.

The audion has many applications in radio. It is greatly used as a detector of the weak high-frequency currents induced by passing radio waves radiated from distant transmitting stations.

In previous articles in this section it was explained that it is necessary to rectify these high-frequency currents produced by the radio waves in order that a pulsating current could be produced to operate the telephone receivers and make the signals intelligent to the human senses.

It has been described how some minerals possess rectifying properties to alternating currents and may be used as a simple form of radio signal detector. They possess the ability to pass current in one direction, but resist the current in the opposite direction. The audion is also a very efficient rectifier and will amplify the signal considerably.

The audion may be used in other ways in the reception of radio signals to great advantage. It may be used as an amplifier of high or low frequency currents. In the former case it is used to build up and strengthen the infinitely weak high-frequency currents induced in the receiving antenna before they are rectified; this is known as radio frequency amplification. In the latter case the low frequency variations produced in the output circuit and which would ordinarily actuate the telephone receivers, may be additionally

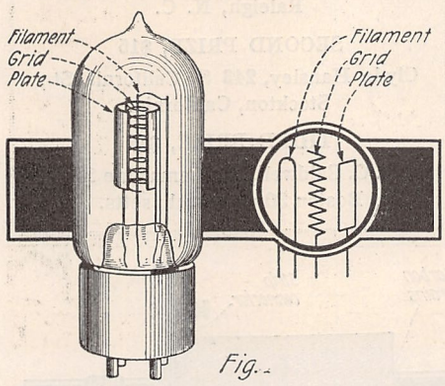


Fig. 1

The Vacuum Tube or Audion Which Is Universally Used Today as a Detector of Radio Waves. Note the Signs Used in Wiring Diagrams.

amplified to produce much greater volume of sound; this is known as audio frequency amplification.

The object of the filament of an audion is not to produce light, but it has been found that electrons are emitted by certain metals when hot. The object of the filament, therefore, is to fill the space surrounding it with free electrons. The electron is the unit of negative electricity. Referring to Fig. 2, it will be noted that the positive side of a battery, B1, is connected through a pair of telephones to the plate of the audion, while the negative side of B1 is connected to the filament. The object of the battery, B2, is merely to render the filament incandescent. When the filament is not heated, no current can flow in the circuit of B1 because the circuit is broken by the space between the plate and the filament. When the filament is heated, current can flow in the circuit, for electrons are emitted by the filament and fill the space between the filament and the plate. These electrons then act as conductors of electricity and the circuit is completed.

It is important, however, to note that this space surrounding the filament of the tube can only conduct electricity in one direction. This is explained by the fact that electrons are unit charges of negative electricity. One of the best known principles of electricity is that like charges repel one another and unlike charges attract one another. Thus, in the case of the circuit of B1, if the battery is

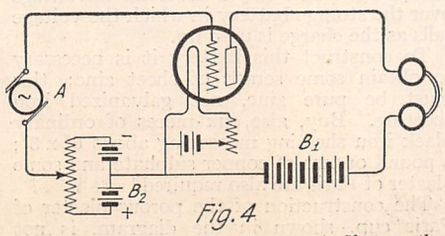


Fig. 4

The Source of Alternating Current A Charges the Grid Alternately Positive and Negative. The Plate Current Therefore Rises and Falls at the Same Frequency.

connected as shown, a current will flow in the circuit when the filament is heated because the plate is positively charged with respect to the filament. The electrons, or negative charges of electricity, are attracted to the positively charged plate. But if an attempt is made to pass current in the opposite direction (that is to say, the polarity of B1 is reversed), the plate will be at a negative potential with respect to the filament. No current will flow in the circuit because the negatively charged plate will repel the electrons emitted from the filament. It follows, therefore, that if a source of alternating current is connected in place of the battery, B1, current will flow in one direction, but will be obstructed in the opposite direction. Consequently the telephones will be traversed by pulsations of current in one direction only. If the frequency is sufficiently high, these pulsations amount to a direct current.

A consideration of Fig. 3 will explain the functioning of the grid in the audion. The grid acts as a valve to control the current in the circuit of B1 just described. For the purposes of explanation, the grid in Fig. 3 is shown connected to the center arm of a po-

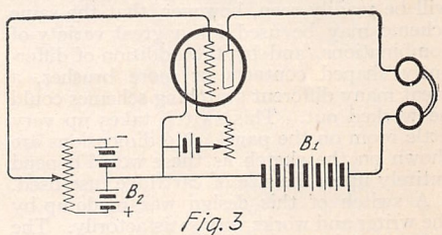


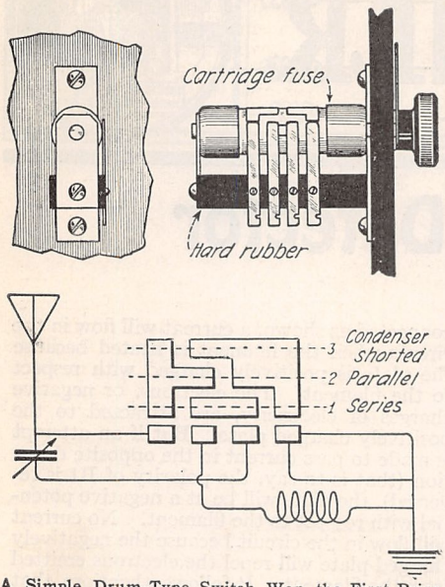
Fig. 3

The Grid Acts as a Valve to Control Current Flow in Plate Circuit. It Repels Electrons from the Filament or Permits Them to Pass.

tentiometer across which a battery is connected. The center of the battery is connected to the filament of the audion. By moving the center arm of the potentiometer, the grid may be maintained at any desired potential with respect to the filament. When the filament is heated, the electrons are attracted to the positively charged plate and the current flows in the circuit of B1. A certain number of these electrons are captured by the grid, which occupies the space between the plate and the filament. If the potential of the grid is varied by moving the center arm of the potentiometer, the grid will tend to attract or repel electron emitted from the filament. If the grid is charged to a sufficiently high negative potential, it will completely obstruct the flow of electrons to the positively charged plate and current will no longer flow in the plate circuit of B1. But if the grid is charged positively, the electrons will again be attracted to the grid and also permitted to pass through the grid to the plate and the current flow in the plate circuit of B1 will be restored. The grid, therefore, effectively controls the current flowing in the plate circuit. Any changes in potential of the grid are immediately recorded by variations in the flow of current in the plate circuit. Moreover this valve action on the part of the grid is not a mechanical, but an electrical one. Consequently there is no mechanical inertia of moving parts and, no matter how rapidly

(*Continued on page* 544)

Awards of the $50 Radio Wrinkle Contest



A Simple Drum-Type Switch Won the First Prize for the Designer, R. H. Reynolds. Its Constructional Details Are Shown Above.

First Prize

HOME-MADE DRUM-TYPE PANEL SWITCH

By R. H. REYNOLDS

The accompanying sketch is of a drum-type panel switch made from an old cartridge fuse.

I believe this sketch is self-explanatory. The wiring diagram shown contemplates using the switch for series or parallel connection of a condenser and inductance. It will be readily seen, however, that the same scheme may be used for a great variety of combinations, and by the addition of differently shaped contacts or more brushes, a great many different switching schemes could be worked out. This switch takes up very little room on the panel. No dimensions are shown on the sketch as these would depend entirely upon the size of cartridge fuse used.

A switch of this design was made up by the writer and works very satisfactorily. The brass and pieces were first removed and drilled. The contacts were then riveted to the cylinder by short pieces of copper wire, the brass plates being countersunk and the rivets filed off smooth. The end pieces were then replaced and soldered to the brass rod used as a shaft. The four spring brass brushes were fitted into grooves cut in the hard rubber block and held by rivets. Wires from the condenser and inductance were soldered to these brushes. A knob and pointer were used with a simple indicator and stop.

Second Prize

SIMPLE RHEOSTAT WITH FINE ADJUSTMENT

By CLYDE HANSLEY

The second prize was awarded Clyde Hansley for an efficient rheostat of low cost. With this rheostat in the filament circuit of the detector tube, very fine adjustments are possible.

The construction is quite simple as may be seen from the sketch. A tube of high heat-resisting material, such as porcelain, is almost filled with carbon grains. Contact is made to the grains by a small piece of metal sheet which serves to keep the grains in position.

At the front or panel end, a plunger is inserted. The shaft of the plunger should be threaded and the base should be just of correct size to fit the hole. The panel is tapped and the rheostat placed in position. Connections are made to the plunger by a strip of copper or brass. A knob and pointer or dial completes the rheostat. By turning the knob, the plunger moves back and forth and varies the pressure on the carbon grains. The pitch of thread will determine the rate at which the plunger operates. With a fine thread, a complete turn will not greatly affect the current flow; a heavy thread will allow a rather rough adjustment to be made, although it will be a finer adjustment than the ordinary wire rheostat.

Such a receiving rheostat will be satisfactory if carefully constructed.

PRIZE WINNERS

FIRST PRIZE, $25

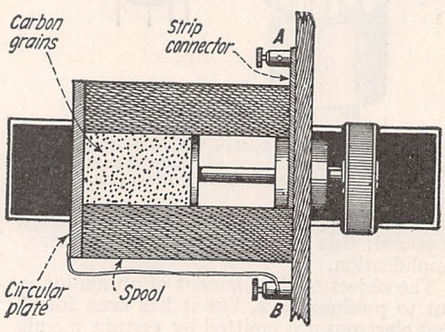
R. H. Reynolds, 103 Park Avenue, Raleigh, N. C.

SECOND PRIZE, $15

Clyde Hansley, 243 S. California St., Stockton, California.

THIRD PRIZE, $10

B. C. Caldwell, 235 Lamartine St., Boston 30, Massachusetts.



Here is a Rheostat for That Critical Detector Tube. It is Not Difficult to Make.

Third Prize

AN EASILY CONSTRUCTED FILAMENT BATTERY

By B. C. CALDWELL

The accompanying illustration shows the component parts and a single unit of the battery which I built as an auxiliary to my storage battery. I found that it does not polarize, gives a perfectly steady current as long as it is used and costs less than a dollar to make.

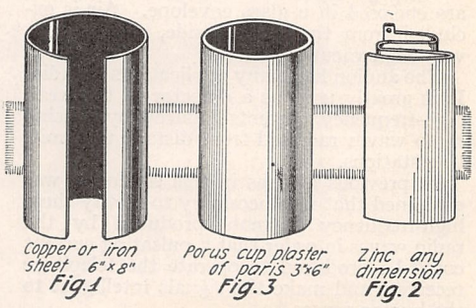
This type of battery is known as a primary battery and is similar to the ordinary dry cell in which electricity is generated by chemical action. One of the elements is gradually consumed but can be easily replaced. This, of course, is not true of the dry cell. If properly made, the primary battery is considerably more powerful than the dry cell and will deliver a continuous current over long periods. This battery uses zinc for the electrode which is gradually eaten away, but so long as some of the zinc remains, the current is constant. This is an advantage over the storage battery in which the voltage falls as the charge is used up.

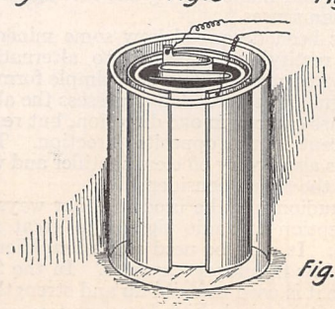
To construct this battery it is necessary to obtain some scraps of sheet zinc; this must be pure zinc, not galvanized iron sheeting. Buy, also, six pieces of ordinary black iron sheeting measuring about 6″ x 8″; a pound or two of copper sulphate and some plaster of Paris are also required.

The construction of the porous plaster of Paris cup, shown in the diagram, is not difficult. The inside of a glass jar about 3″ in diameter should be rubbed over with an oil-cloth; the outside of another jar about 2 3/4″ in diameter should also be rubbed over with oil. Some plaster of Paris should then be stirred into a thick liquid and poured into the bottom of the large glass to a depth of ¼″. This should be allowed to harden and the smaller glass inserted inside the larger one. The space between the two should be filled with plaster of Paris; this should be allowed to thoroughly harden and the glass jars removed. It should be possible to remove these quite easily if they have been properly oiled. Six porous cups should be made in the same manner and handled with care. The zinc and iron sheeting should be thoroughly cleaned with sandpaper and the iron sheeting bent into a semi-circle around the porous cups. A terminal and wire should be soldered or riveted to the top of the iron piece. The zinc should be bent into the shape shown in the diagram and a projecting lug and wire soldered to it.

To assemble the battery, six bottles or jars of suitable size are required. These may be Mason or similar jars with a large opening. If bottles with small openings are the only ones available, the tops should be removed. This may be accomplished by tying a string which has been soaked in alcohol or kerosene around the neck and the string lighted; after it has burnt for a little while, the bottle should be plunged into cold water and the top will break off. The edges can be smoothed off. The iron sheets are first placed inside the containing jar; the porous cup inside the iron sheeting and the zinc inside the cup. A solution of copper sulphate should be poured into the containing jar outside the porous cup and a few crystals of copper sulphate placed on the bottom of the jar. The porous cup should be filled with water to the level of the copper sulphate solution. A few drops of sulphuric acid should also be added to the water in order to start the action. It is advisable to connect the cells in series and short-circuit them for a few hours. A few crystals of copper sulphate should be occasionally added to the solution.

EDITOR'S NOTE:—*Very few really original and useful ideas are being received in this monthly contest. Many of the suggestions are very old or impracticable. There must be hundreds of amateurs who are utilizing some constructional wrinkle of their own. Send us a description of it. If it is a useful suggestion, it will probably win a prize. Write a 200 word description of the article giving constructional details of how it is made. Write plainly; if possible, on a typewriter. Submit sketches or diagrams of the article on separate sheets.*





A Storage Battery for Your Vacuum Tube is Shown Above. It is Very Simple to Construct.

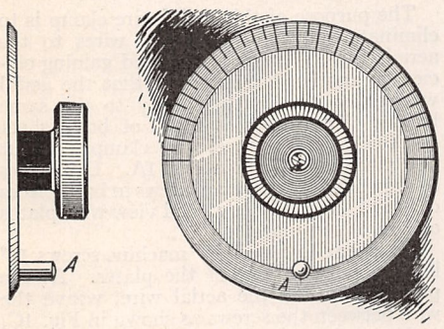
Practical Hints for Amateur Constructors

CONTROL KNOB

Modern radio has resolved itself into the use of dial indicators on the majority of control panels. While trying out various schemes, I happened upon an idea which I have not seen in any of the radio magazines.

The settings on condensers and variometers is sometimes rather critical and hard to attain with the present knobs unless they are rather large and, on compact sets, the use of large knobs is not to be desired on account of the space they occupy.

In any of the popular type of dials that are being offered to-day, drill a hole that will pass an 8/32 screw through the dial on the bottom side about ¼" from the edge, as shown in Fig. 1. Insert an ordinary knob similar to the type used on telegraph keys (¼" in diameter and 1" long). Fit this into the hole just made through the dial and a method of handling the instruments is obtained that is capable of the finest adjustments. For example, place the thumb on the old knob and the forefinger on the new one which has just been attached and give it a slight twist. The ease with which the instrument will respond is then easily noted over the old method.



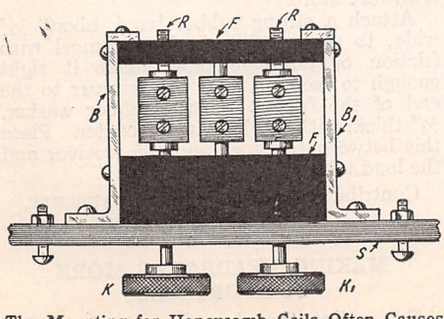
A Boon for the Amateur Who Experiences Difficulty in Making Fine Adjustments with the Regular Knob and Dial is Shown Here.

Contributed by RAY T. FOSTER,
Muldoon, Tex.

HONEYCOMB COIL MOUNTING

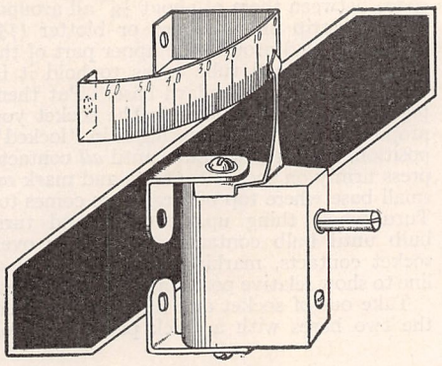
The honeycomb coil mounting shown in the diagram is very easily constructed and is one of the best arrangements for mounting the coils behind the panel. It is often undesirable to have the coils mounted on the face of the panel, especially when close adjustment of the coupling is required. In this arrangement a very fine adjustment can be obtained and at the same time no capacity from the operator's hand need affect the tuning. If desired, this capacity effect can be still further eliminated by shielding the panel.

The method of construction is fairly evident. The two pieces F. F. may be of wood, fibre or bakelite, with holes drilled and tapped to take the rods R. R., to which the two movable mountings are attached. B and B1 are strips of fairly heavy brass bent to the required shape and attached as indicated.



The Mounting for Honeycomb Coils Often Causes Trouble to the Amateur. Here is a Back Panel Mounting that Can be Made Easily.

Contributed by HARRY A. TUBBS,
Co. A., 8th Engineers, Ft. Bliss, Tex.



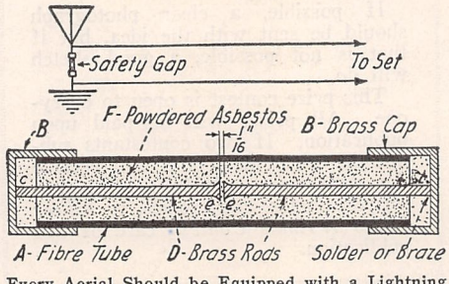
A Scale for the Honeycomb Mounting Requires Very Little Material to Make.

H. C. COIL SCALE AND POINTER

A scale and pointer to indicate the degree of coupling on honeycomb coils is an exceedingly useful adjunct. Most standard mountings do not provide this and, after tuning in a difficult C. W. station, there is no means of recording the degree of coupling that was found to be necessary.

This can quite easily be remedied by the simple arrangement indicated in the accompanying sketch. The scale may consist of an ordinary rule bent to the required shape, while any odd piece of brass may be cut to form a pointer. The latter is attached to the coil mount in the manner shown in the diagram.

Contributed by WM. L. BAYHAM,
Dayton, O.



Every Aerial Should be Equipped with a Lightning Arrester to Comply with the Underwriters' Regulations. This One is so Simple There Can be no Reason for an Amateur to be Without This Protection.

A HOME-MADE LIGHTNING ARRESTER

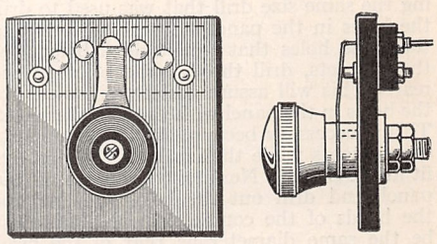
Every amateur's aerial must be equipped with a device to prevent damage and fire caused by heavy charges of atmospheric electricity. I have shown in the illustration how I have made a simple effective lightning gap.

In looking for a suitable device which I could construct at a low price, I happened to think of a large sized blown-out fuse in my junk box. I utilized this, and the result was a fully enclosed lightning arrester, such as can be purchased. The only material necessary, other than the fuse, was a short length of thick copper or brass rod. This was cut into two pieces of suitable length and soldered to the cap as shown. The cap was then put on the tube and adjusted until a very small space was left between the two ends. I have shown a space of 1/16", but it should be less than that. Make it a few hundredths of an inch instead. The shorter the gap the more protection your set is afforded.

The best method of adjusting the metal rods is to drill a small hole over the place where the gap is located and then fix the position by inserting a slip of thin paper between the rods. Press the rods together against the paper and then pull out the paper. This will leave a small gap of the proper size.

A few drops of sealing wax on the caps will prevent them from shifting and shorting. Remove the paper and fill the space as shown with powdered asbestos. Use the sealing wax to fill the opening. The old fuse block may be used for a holder. It would also be well to employ either a fuse which will blow at an ⅛ ampere or a choke coil of six turns of wire on a form 3" in diameter in the lead from the safety gap to the aerial post. Place either choke or fuse, or both, outside the window. They could be on the same base as the gap.

Contributed by W. W. MODELL.

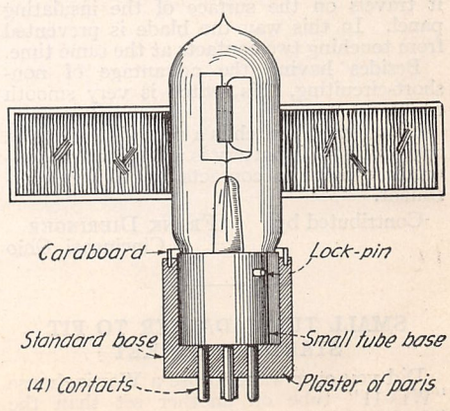


This Switch Will be Useful for B Battery Control. It Prevents Short Circuiting Between Contacts.

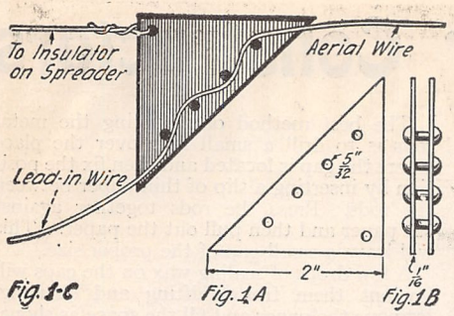
A NON-SHORT-CIRCUITING PANEL SWITCH

It is very likely that many amateurs have been confronted with problems centering upon the panel switch now in common use. One problem to overcome is short circuits between contacts. When the switch blade passes from one contact to the next the blade touches the two contacts at the same time. This connects the two contacts and thereby short-circuiting whatever may be connected to them. If a number of "B" batteries were connected to that type of switch, one can see that they would not last long.

To overcome this a panel switch like the one I describe can be made. Procure contacts, the thickness of the head of which is the same as the thickness of the panel. Lay off the holes for the bearing of the switch lever and also the holes for the contacts. In this case the radius of the switch arm is 1" and the distance between the centers of the contacts is ¼". The next operation is to drill the hole for the switch lever bearing, which is 3/16" in diameter. Then drill the holes for the contacts. First use a drill the diameter of which is the same as that of the shank of the contact. In this case the shank is 3/32" in diameter. Next cut out a piece of



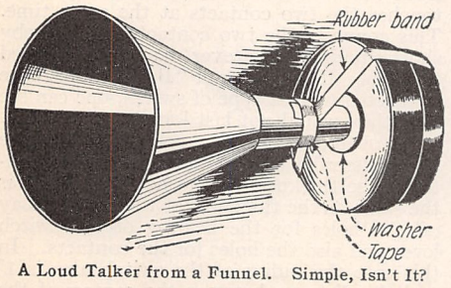
This is a Simple Method of Adapting a Small Westinghouse Tube to Fit a Standard Socket.



This Aerial Clamp Eliminates the Necessity of Splicing the Lead-In Wires to the Aerial.

formica or bakelite large enough to cover the space occupied by the contacts and also allow for the two stops which hold this piece to the panel and at the same time serve to keep the switch blade from running off the contacts. Clamp this insulating block in place, back of the panel. Then drill the two holes for the stops through the panel and also through the block in the rear. Then put the stops in place and tighten the nuts on back. This will hold the block securely to the panel. Using the same size drill that was used to drill the holes in the panel before, and following the same holes that were drilled before for the contacts, drill through the block in the rear. This will assure perfect alignment of the holes in the panel with those in the block. This is necessary because the block supports the contacts while the heads of the contacts fit in the panel. Next take the block off the panel, and drill out the holes in panel for the heads of the contacts. This drill must be the same diameter as that of the head of the contact.

When the switch is assembled the surface of the contacts must be a little below the surface of the panel. If they extend above the surface, the holes in the rear block must be countersunk just enough to allow the contact to come below the surface of the panel. (About .004" is the right distance the surface of the contact should be below the surface of the panel.) After this is done, put the switch blade and knob in place.



A Loud Talker from a Funnel. Simple, Isn't It?

When the blade is passed from one contact to the next, the blade cannot fall in between the two contacts or touch both of them at the same time, or thereby connect the two.

The disadvantage of short-circuiting is eliminated in this type of switch because when the blade passes from one contact to the next it travels on the surface of the insulating panel. In this way the blade is prevented from touching two contacts at the same time.

Besides having the advantage of non-short-circuiting, this switch is very smooth running.

This type of switch is a necessity where an adjustable "B" battery is used or where connections between contacts would be a detriment.

Contributed by FRANK DIERINGER
Cincinnati, Ohio

SMALL TUBE ADAPTER TO FIT STANDARD SOCKET

Did you ever want to use a Westinghouse "WD-11" tube on another set than the "Aeriola, Sr."? It will not fit any socket you can buy and supply houses want $1.25 to $1.50 for an adapter which looks like a makeshift at best.

Try this; it makes a good looking job and works as well as it looks.

Break up any old burned-out detector or amplifier tube. All you need is the brass tube of the base. Try not to burr this and do not remove, or damage, the little lug or pin on the side which is used to lock the tube in the socket.

Fitting this standard base over the smaller base of the other tube you will find leaves a space between them of about 1/16" all around. Wrap a strip of cardboard or blotter (1/2" wide is plenty) around the upper part of the base of the small tube so as to hold it in the center of the standard base. Put them together again and place in the socket you propose to use, being sure lug is in "locked" position. Push down bulb until *all* contacts press firmly on socket contacts and mark on small base where top of large base comes to. Turn whole thing upside down and turn bulb until bulb contacts are directly over socket contacts, marking both bases with a line to show relative position of the two bases.

Take out of socket and fill space between the two bases with a thick paste made of plaster-of-Paris and water. Fill the large base up flush to the bottom with the plaster. Now remove cardboard or blotter from the top and fill the resulting space with plaster. After the plaster has stood about an hour it will have hardened quite a little and you can clean off the surplus plaster without danger of changing the relative positions of the two bases. After this is done, stand in a safe place over night.

Contributed by WALTER T. OTTO,
Brooklyn, N. Y.

$50 In Prizes

The special prize contest for radio amateurs and beginners is held each month. There are three monthly prizes as follows:

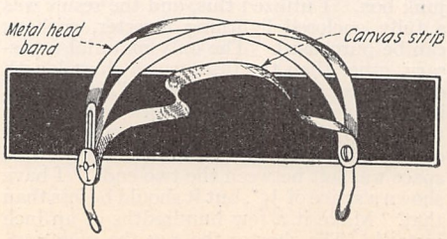
First Prize	$25.00 in gold
Second Prize	$15.00 in gold
Third Prize	$10.00 in gold
Total	$50.00 in gold

What we desire is simple ideas exclusively for the beginner and the novice, the simpler the radio idea, the better the chance to win the prize.

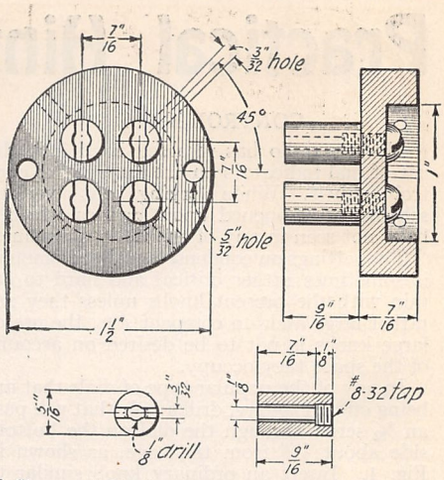
There are lots of valuable little stunts that you amateurs run across every month, and we mean to publish these for the benefit of the entire Radio fraternity.

If possible, a clear photograph should be sent with the idea, but if that is not possible, a good sketch will do.

This prize contest is open to everyone. All prizes will be paid upon publication. If two contestants submit the same idea, both will receive the same prize. Address all manuscripts, photos and models, to *Editor Radio Wrinkle Contest*, care of this publication.



Those Murdock Phones May be Made More Comfortable by This Little Scheme.



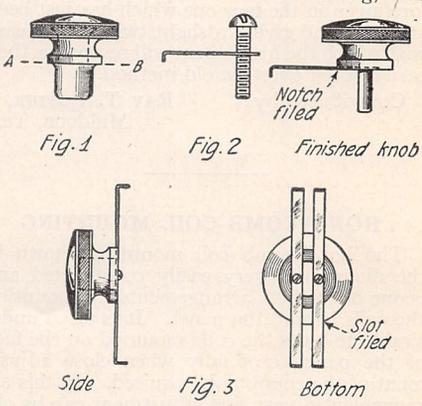
A Cheap and Efficient Vacuum Tube Socket May be Made Easily, as Explained in the Description.

AERIAL LEAD-IN CLAMPS

The purpose of this aerial-wire clamp is to eliminate splicing the lead-in wires to the aerial, thereby saving time and gaining efficiency; another advantage is that the aerial wires may be adjusted easily to the same length. The clamp is made of brass sheet 1/16" thick. To connect this clamp, cut out two pieces as shown in Fig. 1A. Drill holes as shown for 8/32" machine screws in both pieces of brass. Fig. 1B shows end view with plates and screws in place.

To assemble, insert 8/32" machine screws 1/2" long in holes of one of the plates. At the proper point on the aerial wire, weave the wire between the screws as shown in Fig. 1C, and put the other plate in place over this wire. Tighten two 8/32" nuts on each screw to hold the wire firmly. The clamp is then ready to fasten to the insulator or spread by means of a short piece of wire.

Contributed by KARL NOQUIST,
Stromsburg, Neb.



Another Soiution for the High Cost of Radio Apparatus. We Have Found How to Secure Panels and B Batteries from the Old Storage Batteries. Now We Can Make Knobs from the Caps on the Same Battery.

A LOUD SPEAKER FOR THIRTY CENTS

The accompanying sketch shows a very good, loud speaker that can be constructed from an ordinary funnel purchased from any hardware store.

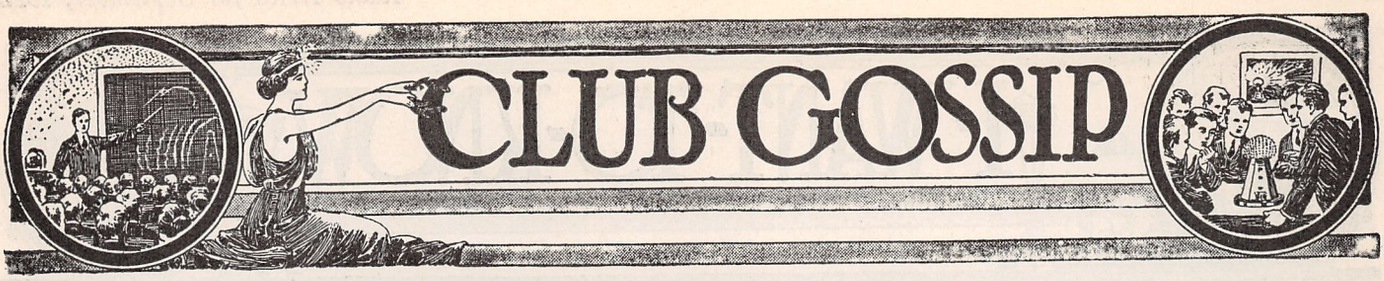
Attach a strong rubber band, about 1/2" wide, to the small end of the funnel with friction or adhesive tape, make it tight enough to securely hold the receiver to the end of the funnel. Cut a rubber washer, 1/4" thick, with 1/2" hole in the center. Place this between the horn and the receiver and the loud talker is complete.

Contributd by W. J. BRAUBLETT,
Charleston, S. C.

MAKING HEADBANDS MORE COMFORTABLE

By putting the phones on the head and measuring the distance from one adjusting

(*Continued on page* 578)



BOYS' RADIO CLUB OF ALAMEDA

The first meeting of the Boys' Radio Club of Alameda was held on June 10, 1922, at the home of the secretary, Barton Cuyler.

There were five charter members present at the meeting, who conversed about many important matters.

We have a permanent club room at 2527 Central Ave., Alameda, California.

As yet we have not purchased a receiving set, but expect to do so very soon.

The aim of the club is to assist its inexperienced members in the construction of their sets.

Meetings are held every Saturday evening and all members are very enthusiastic about radio.

THE CONCORD RADIO CLUB

The first meeting of the Concord Radio Club was held at St. Simons Parish Hall on March 13, 1922.

It has at present 17 members. At every meeting there is a talk on a certain piece of apparatus. Our instructor gave a lecture on "Vacuum Tubes" last month. He holds code practice whenever he thinks the members need it, which is not often.

Donations have been received, showing that the people of the town are interested in this club.

Mr. Hall of Port Richmond, gave the club a radio-concert with a two-step regenerator which boosted the club a lot.

This club would like to hear from other clubs in any part of the country. We would also be pleased if some organization would send a copy of their constitution so we may obtain hints from it.

We would like to have a representative from any other club on Staten Island.

The officers are: Rev. William Winters Mix, president and treasurer; William Seeselburg, vice-president, and Herbert Vermilya, secretary.

Please write to the secretary, 43 Oak St., Concord.

THE PICKWICK RADIO CLUB

The Pickwick Radio Club was organized on Tuesday, May 30, with the purpose of studying radio telegraphy and telephony. Prof. Morecroft's book, "Principles of Radio Communication," will be used as a text-book.

The following are the officers: President, N. Saks; first vice-president, Miss Hanna Pollack; secretary, L. Schwartz; treasurer, P. Pollack, and radio instructor, V. David.

Those interested in becoming members will please communicate with Mr. V. David, 408 Christopher Ave., Brooklyn, N. Y.

THE BRONXVILLE RADIO CLUB (N. Y.)

Shortly after the war, a group of radio enthusiasts in Bronxville formed a club under the name of the "Armour Villa Radio Association." The name of this organization has been changed to the "Bronxville Radio Club" within the last year, and it is entering upon its fourth successful season. The "Bronxville Radio Club" is affiliated with the A. R. R. L. and the officers of the club are as follows:

President, Walter A. Remy (2KV); secretary, Rodney Roach; treasurer, James Maher (2AXP).

Meetings are held every other Friday evening in the Gramatan National Bank, Bronxville, N. Y., through the generosity and interest of the bank officials. The present membership of the club is 28, which number is rapidly increasing. We aim to make our meetings interesting for all by presenting a paper on some radio topic at each meeting, by answering the questions of the novice and giving him all possible advice, and by holding a general discussion.

We consider ourselves fortunate in receiving a complete DeForest phone and C.W. transmitter, motor-generator, etc., from one of the members, Mr. McAllister, towards a club station. We are anxious to exchange messages with other organizations. Call 2AIH.

BOY SCOUT RADIO UNIT OF DONORA, PA.

The Boy Scout Radio Unit of Donora, Pa., has closed its classes for the summer on account of the closing of the Public Schools, wherein they were privileged to meet and work.

The advanced class which is receiving instruction from the National Radio Institute is active in pursuing the course more diligently than heretofore.

With the closing of the present term there were 110 Boy Scouts taught the theory and practical construction of receiving apparatus.

During the vacation period the Scout Council, together with the instructor in radio, will plan for the fall session, beginning in September.

Anyone who wishes to correspond with this Unit, should address the Deputy Scout Commissioner, 488 Fifth Street, Donora, Pa.

The Boy Scout Radio Unit of Donora, Pa., sends compliments to the publishers for the June number of the RADIO NEWS which we consider is the best ever published.

COMMUNITY RADIO CLUB OF DELHI, N. Y.

On May 2 a meeting was held at Delaware Academy to organize and elect the officers. Raymond McKee was elected president; Glenmore Carrington was elected secretary-treasurer; and Miss Inez Wood, the science teacher, was elected vice-president. Meetings have been held every Tuesday evening at 7.30, up to the present time.

The club has the use of the Freshman room and all the science rooms. A home-made outfit is in use at the club now, but as soon as funds can be obtained, we expect to install better equipment.

We have divided the club into two parts, for STUDENTS and AMATEURS. Those who have not at least one year's experience in radio we class as STUDENTS. Those who have had one year's experience or more we class as AMATEURS.

We, the Community Radio Club of Delhi, would appreciate a line or letter of activities of an experienced radio club.

At the present time we have about 20 student members and 4 amateurs.

RADIO CLUB OF PINE BLUFFS, ARK.

A radio club was formed by 53 radio bugs, who on Thursday evening, May 11, gathered at the Cotton Exchange Building. The officers were as follows: Milton Voss, president; Howard Strauss, vice-president; Charlie White, secretary and treasurer. The club will meet every Friday evening in order to give instructive advice to the beginner so he will be able to build his own set by the fall, when prizes will be offered to the best home-made set. We would be pleased to correspond with other clubs.

THE MON-YOUGH RADIO ASSOCIATION OF McKEESPORT, PA.

At the semi-monthly meeting of the Mon-Yough Radio Association, held Thursday evening, June 1, in the club rooms at 326 Fourth Avenue, McKeesport, Pa., the following officers were elected: Vice-president, John Hunter, Duquesne, Pa.; assistant secretary-treasurer, Emil Klob, McKeesport, Pa.; technical committee, H. F. Kelso, Dravesburg, Pa., Donald Willard, chairman, Elizabeth, Pa., Albert G. Moore, Wilmerding, Pa.; membership committee, Walter Estep, chairman, McKeesport, Pa., Albert G. Moore, Wilmerding, Pa., Harry W. Wallis, McKeesport, Pa.

The new officers assumed their duties July 1, for a term of one year.

The Mon-Yough Radio Association is an affiliated society of the American Radio Relay League, and has a membership of 72. Four of the members are licensed operators, two of whom hold a limited broadcasting license identified by call WIK.

Two classes of membership are available, junior and senior, and the membership fee and dues are very nominal. Radio fans are urged to investigate and consider the advantages of affiliating with this association, which meets regularly the first and third Thursdays of each month at 8.00 o'clock P.M. These meetings do much to educate the members regarding the mysteries of radio telephony and telegraphy.

Information may be obtained by addressed a post card to the association at the above address.

8TH WARD RADIO CLUB OF TOMPKINS SQUARE

The club meets at Christadora House, 147 Ave. B, New York City, and has a membership of 30, including juniors and seniors.

Such noted people as Mr. E. A. Glavin, the inventor of the radio-controlled auto car, Mr. E. W. Storm of the Radio Corp. of America, and Miss Bertha Brainerd of WJZ broadcasting station, who speaks from that station on Broadway successes, will address the club on radio and the theatre. We are still looking for new members who live in the neighborhood of Houston and 20th Sts., Manhattan.

Address all letters to Martin Remnek, secretary, 8th Ward Radio Club, 147 Ave. B, New York, N. Y.

The Development of Radiophone Broadcasting

By L. R. KRUMM*

ON February 27 of this year there was held in Washington an open hearing before a committee of radio engineers, military officers and governmental representatives, appointed by the Secretary of Commerce to formulate proposed laws and regulations to meet the new radio conditions which have developed since the termination of the war. Nearly two hundred representatives of various commercial, amateur and governmental radio interests attended this conference. The large number of reporters, photographers and moving picture operators in attendance also indicated the great public interest in this meeting.

What caused this sudden interest in new radio legislation? There have been no radical changes in the radio art as applied to international communication between the high powered stations in this country and those in foreign lands. Neither have there been any particular changes in radio communication between ships and between ships and shore stations. There have been some developments in radio telephone communication between ships and airplane and ground stations and in regard to locating ships at sea by means of radio and even some advance in communicating with submarines while submerged, but these were not the answer to our question.

The main purpose of this conference was to devise means to meet the problems which had arisen through the establishment of the radio telephone broadcasting stations which are sending out news, live stock and grain reports, weather forecasts, sermons, speeches and entertainment and which have caused the installation during the last year and a half of anywhere from 700,000 to 1,000,000 radio receiving stations, representing a probable expenditure of approximately $75,000,000.00.

Previous to the establishment of broadcasting stations working on absolutely dependable schedules, the public's interest in radio had been limited to the technically inclined amateur operators with some knowledge of the electrical principles involved in radio telegraph communication. These men were dyed in the wool faddists on radio. They wanted to know what "made the wheels go round" and how to make them go. They wanted to establish radio telegraph transmitting stations; for this it was necessary to study the Continental Morse code and secure operators' licenses from the Government. All this they did in addition to investing considerable money and time in the purchase and installation of the equipment.

It was estimated before the World War that there were some 6,000 licensed amateur transmitting stations and probably 50,000 receiving stations which required no license. All these were closed during the war. The amateur receiving stations were allowed to reopen April 15, 1919. On October 1, 1919, amateur transmitting stations were allowed to operate again. The amateur radio activities had languished during the war period

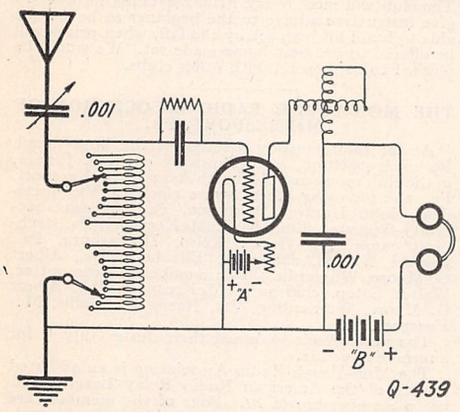
(*Continued on page* 589)

**Superintendent of Radio Operations of the Westinghouse Electric & Manufacturing Company.*

THIS Department is conducted for the benefit of our Radio Experimenter. We shall be glad to answer here questions for the benefit of all, but we can only publish such matter of suffic ent interest to all.

1. This Department cannot answer more than three questions for each correspondent.
2. Only one side of the sheet should be written upon; all matter should be typewritten or else written in ink. No attention paid to penciled matter.
3. Sketches, diagrams, etc., must be on separate sheets. This Department does not answer questions by mail free of charge.
4. Our Editors will be glad to answer any letter, at the rate of 25c for each question. If, however, questions entail considerable research work, intricate calculations, patent research, etc., a special charge will be made. Before we answer such questions, correspondents will be informed as to the price charge.

You will do the Editor a personal favor if you will make your letter as brief as possible.



A Good Single Circuit Receiver Employing a Variometer for Tuning.

CONVERTING A CRYSTAL SET TO V. T.

(439) T. Elvin of New York, asks:

Q. 1. Can I adapt the "Junior Crystal Receiver" described on page 1107 of the June, 1922, issue of RADIO NEWS to a regenerative vacuum tube receiver?

A. 1. Yes. It is possible to change this crystal receiver into a V. T. set with regeneration.

Q. 2. What other parts will be necessary?

A. 2. One variometer, tube socket, rheostat, grid condenser and leak, storage battery, vacuum tube (detector) and B battery of 22 volts. Assemble the extra material on a panel with the same dimensions as the first and mount in a similar manner. Disconnect all the connecting wires in the crystal set and hook up both panels.

Q. 3. Please show hook-up so that I can connect the receiver into a tube set.

A. 3. The diagram of connections is shown on this page. Use number 18 wire run in cambric tubing for connections. It would be well to shield the panels with tinfoil to eliminate body capacity.

CHOKE COIL AMPLIFIER

(440) W. Bailey, Toronto, Canada, asks:

Q. 1. Please publish diagram of a one-step choke coil amplifier.

A. 1. Diagram requested by you is published on this page.

Q. 2. How can I load a 600-meter variocoupler to receive 1500 meter stations?

A. 2. Insert in primary and secondary circuits a loading coil of 200 turns of No. 24 D. C. C. on form 3 inches in diameter. Tap each coil at every 25th turn.

Q. 3. What advantage or disadvantage would result from using No. 24 instead of No. 20 on the primary of a spark coil?

A. 3. The coil would not stand up under load as well, because No. 24 is smaller than No. 20 and cannot carry as much current.

LONG AND SHORT WAVE SWITCH

(441) Max Werner, Alden, Kansas, writes:

Q. 1. Please state size of honeycomb coils for 600 and 2500 meter reception.

A. 1. For 600 meter reception, the primary coil may be L100, the secondary L75 and the tickler L75. For receiving on 2500 meters L300 for primary, L300 for secondary and L100 for tickler.

Q. 2. Please publish circuit of combined honeycomb coil and variometer set with change-over switch.

A. 2. The desired circuit is given on this page. Only a triple pole single throw switch is necessary.

BUZZER TRANSMITTER

(442) R. Smith of Newark, New Jersey, writes:

Q. 1. Where may I address a letter to Mr. Lacault, writer of several articles in RADIO NEWS?

A. 1. Mr. Lacault is Associate Editor of RADIO NEWS and a letter to this magazine will reach him.

Q. 2. Which is better, magnetic or bulb modulation for a phone transmitter?

A. 2. In general, bulb modulation will prove more efficient than magnetic modulation, provided the circuit used is correct.

Q. 3. Please publish diagram for a buzzer transmitter?

A. 3. A good hook-up for a buzzer transmitter is shown on this page.

SINGLE CIRCUIT RECEIVER

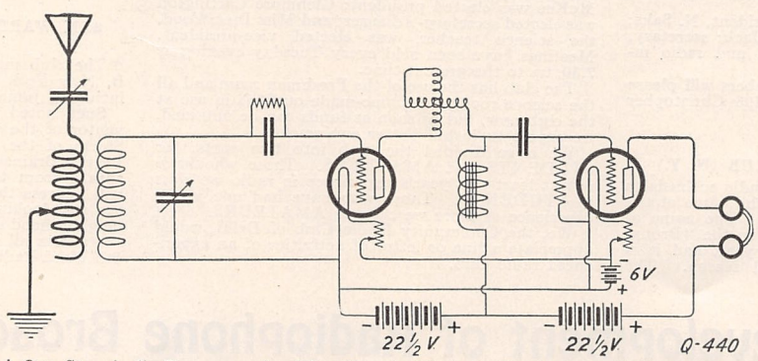
(443) R. Featherstone of Indianapolis, Indiana, asks:

Q. 1. Please publish hookup for a single circuit, variometer tuned, regenerative receiver, employing honeycomb coils or spider web coils as variometer.

A. 1. A circuit of this type is shown on this page. If spider web coils are used you will not be able to cover a very large band of wave lengths unless they are tapped or mounted on plugs so that they may be interchanged, similar to honeycomb coils.

Q. 2. What coils will be needed to cover band of wave lengths from 200 to 2000 meters?

A. 2. Using honeycomb coils, eight will be required; they are, for 200 to 500 meters, L25 or 50 for primary, L25 or 50 for secondary and L50 or 75 for tickler; for 600-1000 meters, L100 or 150 primary, L100 secondary and L75 or 100 for tickler; for 1000-2000 meters, L200 primary, L200 secondary, 100 or 150 for tickler. Spider-web coils each 250 turns, tapped every 25 turns could be used.



A One-Step Audio Frequency Amplifier May be Made by Employing a Choke Coil as Illustrated.

FIVE WATT TRANSMITTER

(444) S. Martin of Marysville, Mo., asks:

Q. 1. What is a good hookup for a five or ten watt C.W. transmitter? The current available is 110 A.C.

A. 1. A suitable hookup appears on this page.

Q. 2. How many jars should I use in the rectifier for this set?

A. 2. Six jars on each side of the line will safely rectify the plate power.

AUDION-ULTRAUDION SWITCH

(445) Marion Simms of Des Moines, Iowa, requests the following information:

Q. 1. Please print a hookup using coupler, audion-ultraudion panel, 43 and 23 plate condensers, phones, etc.

A. 1. A diagram of connections for such apparatus appears on the next page.

SPARK COIL AS PLATE POWER

(446) H. Reen of Newtonville, Mass., writes:

Q. 1. Is it possible to use secondary of a quarter-inch spark coil in the choke coil amplifier described on page 206 of the September 1921 issue?

A. 1. Yes. Such a coil will give good results if the rest of the set is correct.

Q. 2. Can a spark coil be used to supply the high tension current for the plate of a vacuum tube transmitter? If so, will you please publish a good hookup?

A. 2. It is possible to use a quarter-inch spark coil for this purpose. A suitable circuit is shown on this page. It would be better to employ a transformer or a separate battery to heat the filament because, when the key operating, the coil is closed and the filament voltage will drop. This is the time when the filament voltage should be highest. If a transformer is used, the connection to the inductance should be made from a center tap.

RADIO FREQUENCY AMPLIFICATION

(447) C. Neth of Cleveland, Ohio, asks:

Q. 1. Please publish a hookup employing a regenerative receiver and three step radio frequency amplifier using a loop for reception.

A. 1. Information regarding radio frequency amplifiers may be obtained from the July 1922 issue of RADIO NEWS, "I-Want-To-Know" department. The loop should be connected to the grid and filament of the first radio frequency amplifying tube. A condenser should be shunted across the loop contacts, which will furnish the wave length control.

RADIO AND AUDIO TRANSFORMERS

(448) M. Williams of Plainfield, N. J., asks:

Q. 1. Can I use Federal audio and Radio Instrument Co. radio transformers in the circuit shown on page 796 of May, 1921 RADIO NEWS?

A. 1. The type of transformers you name should prove successful with this circuit.

Q. 2. What value should the fixed condensers shunting the primary windings of the audio frequency transformers, be?

A. 2. The usual phone condensers of .002 Mfd. will serve. Condensers of .001 Mfd. should also be shunted across the secondary windings to pass the high frequency oscillations.

GRID LEAK RESISTANCE

(449) R. S. Cairns of Campbellford, Ontario, writes:

Q. 1. Please give me a diagram of a one-stage radio amplifier, detector and two-step audiocomplete with automatic filament control jacks.

A. 1. A circuit employing four tubes and filament control jacks was shown on page 69, question 402, July 1922, issue.

Q. 2. What value of resistance should the grid leak have?

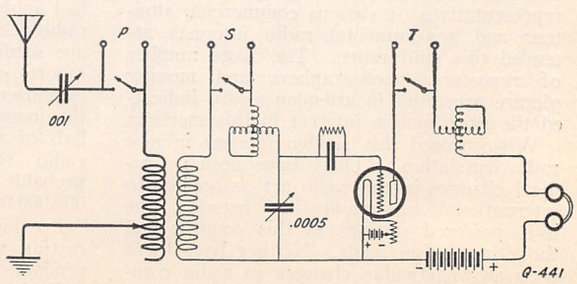
A. 2. The resistance of the grid leak should be variable, ranging from a half to two megohms. The correct resistance will vary with each tube.

COUNTERPOISE INSTEAD OF GROUND

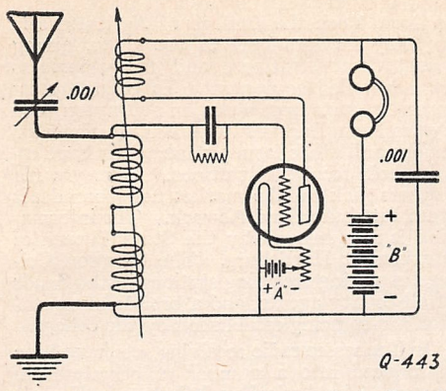
(450) Howard Kimball, Blanding, Utah, wants to know:

Q. 1. Is the France magnetic rectifier self-polarizing?

A. 1. We would suggest that you write the



Only a Three-Pole, Single-Throw Switch is Required for Changing From Long to Short Waves With This Hookup. P, S and T Represent a Honeycomb Mounting.



Many Amateurs Wish to Change Their Crystal Receiver Into a Vacuum Tube Set. This Shows How it is Done.

France Manufacturing Co., Cleveland, Ohio, to obtain this information.

Q. 2. Can I use a radio frequency transformer after the detection of the signals?

A. 2. Radio frequency transformers are placed before the detector tube so that weak signals may be amplified sufficiently to be rectified by the detector tube. After the radio frequency impulses have been rectified only audio frequency transformers should be used to increase the signal strength.

Q. 3. Can an aerial and counterpoise be used in place of an aerial and ground for reception as well as transmission?

A. 3. It is possible to use an aerial and counterpoise for reception. It may prove better than the regular ground if the ground is not very good, but, in general, it is unnecessary.

A. C. FOR DETECTOR TUBE

(451) Lloyd A. Noggle, Columbus, Ohio, asks:

Q. 1. Can a transformer supplying six volts A.C. be used to light the filament of detector and amplifying tubes together with a plate supply of rectified A.C.?

A. 1. A.C. can be used on the filament of detector tube alone but results when used with an audio frequency amplifier will be very unsatisfactory. An article on this topic appeared in RADIO NEWS September, 1921.

Q. 2. What size and how many turns of wire will a loop for 360 meter reception require?

A. 2. Six turns of No. 18 wire on a frame 4 feet square, each turn spaced ½-inch, will give good results.

RANGE OF RECEIVING SET

(452) D. Smythe Co., of Newark, Mo., asks:

Q. 1. Is it possible to use a two-stage radio amplifier, detector and two-step audio frequency amplifier?

A. 1. It is possible to employ such a set. A similar hook-up appeared in the July 1922 issue, in the "I-Want-To-Know" Department.

Q. 2. How far will such a set receive?

A. 2. So many variable factors govern the range that only a guess could be given and the true range might be found to be much greater or perhaps less than the approximated range. The only reliable method is to give the set an actual trial.

BATTERIES FOR FILAMENT USE

(453) Chester Olson, of Stony City, Iowa, asks:

Q. 1. If I use a six-volt battery and a six-ohm rheostat on either a vacuum tube drawing .7 ampere at four volts or another tube which draws 1.1 amp. at 5.4 volts, which tube will use the least current?

A. 1. In either case the total current used will be almost the same. The added resistance to cut down the 6-volt supply to 4 volts will draw the extra current.

Q. 2. Can a variometer receiver be used in connection with a radio frequency amplifier or will a loose coupler, tuned with variable condensers, be just as efficient?

A. 2. Either will give good results when properly connected and tuned.

Q. 3. Can gravity cells be used instead of a storage battery to supply the filament current?

A. 3. Gravity batteries do not prove satisfactory when used constantly.

SIX TUBE RECEIVER

(454) J. Avritch of Grand Forks, N. Dak., asks:

Q. 1. Can I use the enclosed hookup and add two stages of radio frequency and three stages of audio frequency?

A. 1. Yes, the July 1922 issue contained information on this subject in the "I-Want-To-Know" Department.

Q. 2. Could I use this set with a loop aerial?

A. 2. A loop aerial or flat-top will give you good results.

Q. 3. What firm manufactures the Acmephone?

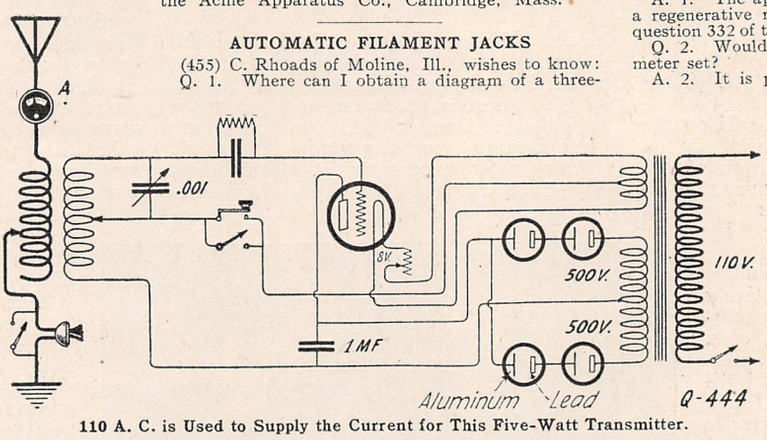
A. 3. The "Acmephone" is manufactured by the Acme Apparatus Co., Cambridge, Mass.

AUTOMATIC FILAMENT JACKS

(455) C. Rhoads of Moline, Ill., wishes to know:

Q. 1. Where can I obtain a diagram of a three-step audio frequency amplifier using automatic filament control jacks and honeycomb coils?

A. 1. Question 402 in the July 1922 issue shows the use of automatic filament control jacks. The honeycomb coil hookup will be found in this issue. Connect the output terminals of the tuner and detector to the input terminals of the amplifier.

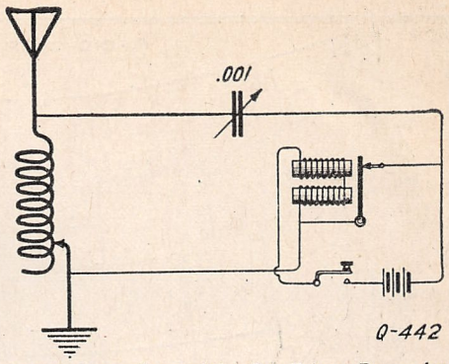


110 A. C. is Used to Supply the Current for This Five-Watt Transmitter.

PLATE POWER

(456) L. Hammond of Guelph, Ontario, wants to know:

Q. 1. Would it be practical to build a D.C. generator supplying 500 volts to the plate of a vacuum tube transmitter?



A Short Range Transmitting Set, Using a Buzzer for Power.

A. 1. Not unless a complete workshop is available and you have had experience in that line.

Q. 2. Would it be possible to use ordinary house current for this purpose?

A. 2. If A.C. is available, yes. You will need a power transformer and some form of rectifier. If 220 D.C. is available it may be applied direct to the plate for short distance work.

REGENERATIVE RECEIVER

(457) C. Pipher, of Pratt, Kansas, wishes to know:

Q. 1. Can a variocoupler and two variable condensers be connected up as a regenerative set?

A. 1. The apparatus will be sufficient to hookup a regenerative receiver similar to that described in question 332 of the March 1922 issue of RADIO NEWS.

Q. 2. Would this set be as efficient as a variometer set?

A. 2. It is possible, by careful tuning and use of the correct constants to make this set work as well as the regular variometer circuit.

Q. 3. May loading coils be used to increase the wavelength of any short wave set?

A. 3. It is possible to load up a short wave set but each circuit must be loaded separately, i.e., a coil in aerial, secondary and plate circuits.

TEST TUBE "B" BATTERY

(458) R. Hammond of Orland, Cal., asks:

Q. 1. Please tell how to make a "B" battery of 22 volts from test tubes.

A. 1. A description of an efficient test tube "B" battery appeared on page 823 of the March 1922 issue.

Q. 2. If an aerial is erected 15 feet above a 100-foot building, what is the effective height?

A. 2. The aerial in such a case would be 115 feet high. If, however, water pipes connected to ground run near the roof or a grounded metal roof is on the building, the effective height will be less. When calculating wavelengths, this must be remembered.

Q. 3. Does it matter if shellac is used on the coils of a variometer?

A. 3. If an excessive amount of shellac is used, the distributed capacity will be increased, with resulting broadness in tuning. Very thin shellac will not greatly affect reception and will prevent the coverings from absorbing moisture and forming partial shorts.

(*Continued on page 563*)

Of What Use Are Market Reports?

By J. FARRELL

MR. RADIO FAN in his two-by-four cubicle in a Manhattan cliff dwelling pulled the receivers off his ears with disgust.

"Why in Hades," he shouted, "do they keep sending these agricultural reports? Bah!"

And thereby hangs a tale.

The ether (?) is not inexhaustible for radio purposes. The Department of Agriculture early appreciated this fact and sought to organize the broadcasting of market reports on a solid basis before the ether was entirely preempted by other agencies. With the cooperation of the Post Office Department it began to broadcast market reports from five or six radio stations used in the Air Mail Service. This was by radio telegraph.

Then came the radiophone. It was seen that the oral transmission of market reports was the ideal method of broadcasting the news, and the Department made every effort to induce radiophone broadcast agencies to include the market reports in their programs. This the broadcast stations did, principally because the Department's radio market news service was well organized, and they could get the reports quickly.

"But of what value to us are market reports?" the rapidly increasing number of novices inquired. "Give us more Jazz." Most of these novices are located in cities. They have no direct interest in agriculture.

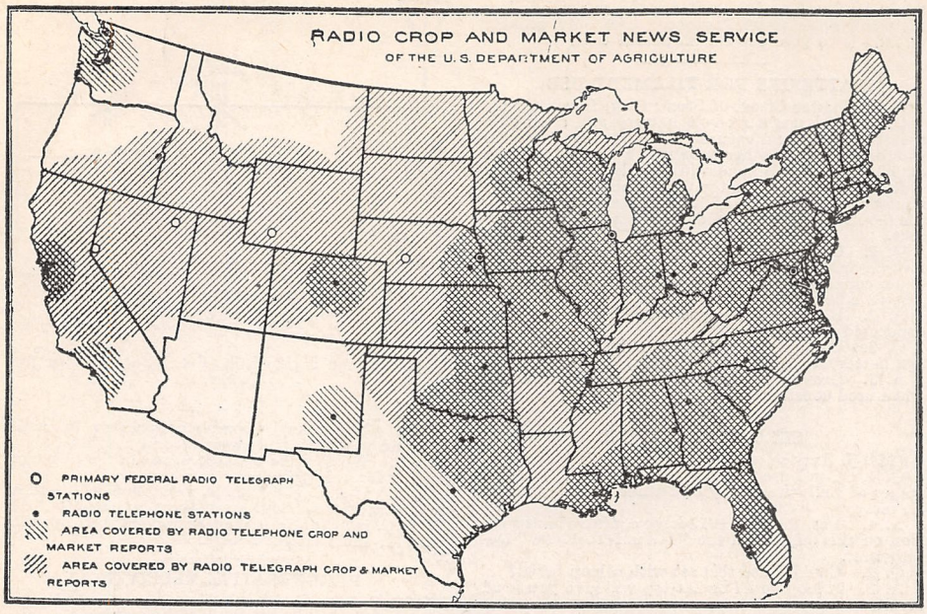
The radiophone broadcasters answered not, but continued to send out the messages. Way back in their heads they realized that to be a success the radiophone should be a service medium as well as a source of entertainment. And the broadcasting of market reports, news bulletins, lectures, sermons and the like fulfilled that function.

"But we're not concerned with cabbage quotations!", the novices reiterated. The radiophone people began to weaken.

About that time a national radio conference was called by Secretary Hoover. The various government departments were represented at the conference, the Department of Agriculture by W. A. Wheeler, in charge of the Radio Market News Service. At the conference Mr. Wheeler detected a peculiar note. Everybody was talking about the use of radio in various fields of endeavor, but little was being said about agriculture.

Mr. Wheeler arose.

"Gentlemen," he said, "I regard radio as of greater importance to the rural population of this country than to any other one class of people. There is no single use of radio except for marine and aerial purposes that should take precedence over its utilization for the benefit of agriculture. There are more than 32,000,000 people on farms, comprising nearly one-third the total population of the United States. Most of these people are located where they are practically cut off from immediate contact with the outside



The Latest Radio Map of the United States, Showing Location of Broadcasting Stations Which Issue Crop and Market Reports.

world. The radio is the only means of getting to them quickly at small cost the economic information necessary in the proper conduct of their business."

To a man the conferees were sold on the proposition, and went away vowing that a larger portion of their programs should be devoted to agriculture. They knew that although the majority of "listeners" were located in cities the radius covered by the stations reached far out into the country, and that the service would be justified even though comparatively few farmers received and used the market information. They knew, even though the city novices might not, that the service would benefit both farmers and urbanites alike. Mr. Wheeler had told them that the proper distribution of farm products depended in large measure upon the quick transmission of market news to farmers.

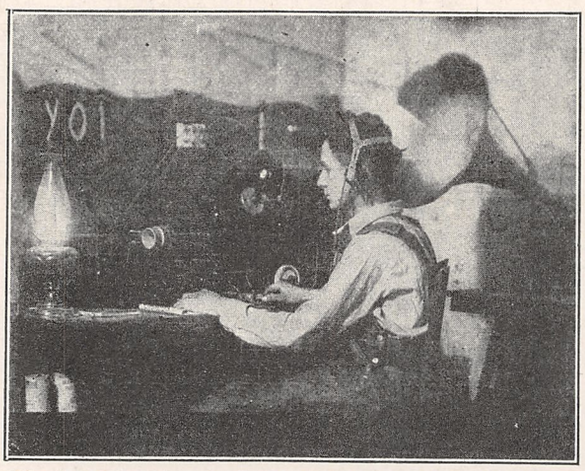
Thus has agricultural news become an important part of broadcast programs. Upwards of forty-five public and private broadcast stations now send out market and crop reports both by radio telegraph and radiophone. The sending end organized, and growing rapidly, the Department is now devoting attention to the receiving end, for it is seen that no matter how much information is sent out, it is valueless if it is not received and used.

Traditionally slow to take up innovations, farmers have been quick to see the possibilities of radio. Everywhere throughout the country they are either installing receiving sets or getting in touch with existing stations. True, the number is small compared with the number of novices in cities, but it is rapidly growing larger, and is increasingly justifying the sending out of the market news.

In Colorado there is wide interest in the subject and receiving stations are being established in various parts of the State. Farm radio clubs have been formed in Boulder County and others are being planned. In Connecticut the State Agricultural College states that it will be only a question of time before county agents will have receiving sets. Already some farmers there are making use of radio service, and several boys' and girls' clubs have receiving sets.

In Illinois a number of county agents have receiving sets in their offices and many farmers are equipped to pick up the market reports and other news. Many high-school boys have receiving sets, and the Illinois Agricultural Association is planning a systematic method of sending out radio news to farmers. Farmers in northern Indiana receive reports from the Chicago Board of Trade, and also pick up the live stock market reports sent out by the Federation of Farmers' Associations. In Maine farmers receive messages from the Springfield station, and the farm bureaus are planning to put receiving sets in their offices.

Many amateur operators in Maryland receive the market reports and pass them on to farmers, and the Agricultural College expects to make radio a general project in club work. In Minnesota the State University broadcasts market and other information, and a number of county agents have receiving sets. There is wide interest in radio in Minnesota, and extensive plans for serving the farm population are being made.



This Amateur Relays Crop and Market Reports on His Phone Transmitter to Farmers in the Neighborhood Who Are Equipped With Only Short Distance Receivers.

In Mississippi the Agricultural and Mechanics College plans to introduce radio at the college and use it in extension work. The State Marketing Bureau of Missouri broadcasts market reports from Jefferson County to hundreds of farmers throughout the State. Some county agents have radio receiving sets. In Nevada the county agent at Yerrington receives the market information and other news broadcasted from the Reno and Elko stations, and relays it to farmers over line telephone wires. It is expected that receiving sets will be in common use among county agents in this State.

In New Jersey the radio club at Toms River is doing an important work in receiving messages and relaying them to farmers. In New Mexico the broadcasting of market reports and other information will be started this fall by the State College, and county agents will be equipped with receiving sets.

In New York the College of Agriculture is teaching farmers how to use radio, giving visual demonstrations, and many farmers have installed equipment. In Ohio farmers receive reports from a station at Dayton used by the Farm Bureau. In Oklahoma farmers' unions and other farm organizations have established receiving stations. Pennsylvania farmers pick up the market news broadcast from Pittsburgh and Newark. The information is also relayed by the State Bureau of Markets at Harrisburg. The Clemson College is placing receiving stations in the hands of all county agents, and a broadcasting station is also being established by the college.

In Tennessee radio receiving sets have been introduced into a number of private farm homes. The Agricultural College in Utah is now negotiating for high-powered receiving and broadcasting apparatus to be located at the college. Market, weather and other news will be sent out, and all county agents will have receiving stations.

Perhaps the most completely organized state for receiving the news is Wisconsin. Here radio is the one topic of conversation. Everywhere the farmers are singing its praise as a result of personal experience. The Agricultural College is strongly back of the work and sends representatives into rural sections to demonstrate equipment. During July and August M. M. Littleton, radio operator for the State Department of Markets at Madison, Wis., will go into the field and assist in installing radio-receiving outfits, and show bankers, county agents, editors and others how to handle the market, crop and weather news. Between twenty and thirty counties will be covered in this way. The State Department already has record of 900 receiving sets on farms in the State, and by fall it is expected that this number will be materially increased.

Thus reads another chapter in the romance of radio—radio on the farm. And it is serious business, for with radio the farmer for the first time is able to get the market information so necessary in properly conducting his business. As a result farmers know up to the minute just where supplies of farm products are needed by consumers in large markets, and where there is an abundance. The information enables them to regulate their marketing activities so that products will be distributed to the best advantage of themselves and the consumer. Waste will be eliminated.

To be sure, farmers are also delighted to receive the entertainment that radio affords. Radio gives the farm folks in isolated places undreamed of advantages. The city man already has these advantages. Theatrical and other entertainment are at his elbow. He gets his daily paper hot from the presses. The farmer enjoys none of these things. His entertainment comes out of a phonograph; his newspaper arrives several days late. But the old order changeth, for as Mr. Wheeler states, radio brings the whole world to the farm door.

The Radio Crop and Market News Service

FEDERAL, STATE AND PRIVATE BROADCASTING STATIONS

The following is a broadcasting schedule of market reports by radio. These reports are sent as press items except where it is indicated that they are sent in code form. Forms are necessary for copying the reports sent by code, sample copies of which may be obtained from this Bureau for Federal and Air Mail Stations, and for all others by writing to the broadcasting station direct. While this schedule is not complete, it is the most accurate that can be prepared from the information available, and will be revised as rapidly as data are received.

Name and Call. Letters of Station	Nature of Reports	Source	Time of Transmission	Type of Transmission
ARLINGTON, VA. (Washington, D. C.)			East. Std. Time	
	Live stock receipts 5 or more principal markets (code)	Fed.	8.45 a.m.	Teleg. 5950 meters continuous wave transmission.
	Weather forecast	"	10.00 a.m.	
	Hog market flash, Chicago and St. Louis	"	11.15 a.m	
Navy Radio Station	Fruit and vegetable shipments and shipping point information	"	11.20 a.m.	"
NAA	Fruit and vegetable markets	"	*1.40 p.m.	"
	Crop reports and special market news	"	*2.25 p.m.	"
	Closing live stock markets	"	*3.45 p.m.	"
	Hay and feed markets (Mon., Wed., Fri.)	"	*4.00 p.m.	"
	Weather forecast	"	*5.00 p.m.	"
	Daily marketgram	"	*5.30 p.m.	"
	Weather forecast	"	9.45 p.m.	"
AMES, IOWA			Central Time	
Iowa State College WOI	Information not available			Phone.
ATLANTA, GA.			Central Time	
Atlanta Constitution WGM	Information not available			Phone.
ATLANTA, GA.			Central Time	
	Weather reports	Fed.	12.00 noon	Phone.
Atlanta Journal	Market report, close on cotton, grain and spot quotations		2.30 p.m.	"
WSB	Entertainment	Local	4.00 p.m.	"
	Ball score, news, etc	"	5.00 p.m.	"
	Entertainment	"	7.00 p.m.	"
AUSTIN, TEXAS			Central Time	
	Opening cotton and grain markets		9.30 a.m.	Phone.
University of Texas	Noon call on cotton	Local	12.30 p.m.	"
	Live stock report	"	2.45 p.m.	"
WCM	Close on cotton and grain	"	3.15 p.m.	"
	Laredo onion report and general shipping point news	"	4.00 p.m.	"
	Report on markets of Dallas, Ft. Worth, Houston and San Antonio, and general crop information	"	8.00 p.m.	"
BOSTON, MASS. (Worcester)			Eastern Time	
	Weather reports	Fed.	11.15 a.m.	Phone.
Clark University	Mass. State market reports	State		"
WCN	Weather reports	Fed.	5.15 p.m.	"
BRIDGEPORT, PA.			Eastern Time	
Diamond State Fiber Co.	Market and crop reports	Fed.	11.45 a.m.	Phone.
WBAG	Music (Thurs.)	Local	7.30 p.m.	"
BUFFALO, N. Y.			Eastern Time	
	N. Y. State market reports	State	12.00 noon	Phone.
Federal Telegraph & Telephone Co.	Weather reports	Fed	5.30 p.m.	"
	N. Y. State market reports	State	5.30 p.m.	"
WGR	Education talks and entertainment	Local	7.30 p.m.	"
CHARLOTTE, N. C.			Eastern Time	
	Weather report	Fed.	11.00 a.m.	Phone.
Southern Radio Corporation	Ball scores, etc	Local	6.00 p.m.	"
	Market reports	Fed.	8.00 p.m.	"
WBT	Entertainment	Local	8.30 p.m.	"
CHICAGO, ILL.			Central Time	
	Fruit, vegetable, live stock and grain (code)	Fed.	2.15 p.m.	Phone.
Westinghouse Elect. & Mfg. Co.	Fruit, vegetable, live stock, grain and dairy products (code)	"	4.15 p.m.	"
KYW	Fruit, vegetable, live stock, and feeds	"	6.00 p.m.	"
	Fruit, vegetable, live stock, grain and dairy products (code)	"	7.30 p.m	"
CHICAGO, ILL.			Central Time	
Union Stock Yards & Transit Co.	Information not available			Phone.
WAAF				
CINCINNATI, OHIO			Central Time	
Cino Radio Mfg. Co.	Wholesale fruit and vegetable report	Fed.	12.00 noon	Phone.
WIZ	Live stock report, Chicago and St. Louis	"	3.00 p.m.	"
CINCINNATI, OHIO			Eastern Time	
Crosley Mfg. Co.	Financial and market report	Fed.	1.00 p.m.	Phone.
WLW	Entertainment, etc	Local	3.00 p.m.	"
	Talks, news items, music	"	8.00 p.m.	"
CINCINNATI, OHIO			Central Time	
Precision Equipment	Wholesale fruit and vegetable report	Fed.	11.00 a.m.	Phone.
WMH	Live stock report, Chicago and St. Louis	"	4.00 p.m.	"
COLUMBUS, OHIO			Eastern Time	
Ohio State Univ.	Information not available			Phone.
WEAO				
DALLAS, TEXAS			Central Time	
The Dallas News	Information not available			Phone.

Name and Call. Letters of Station	Nature of Reports	Source	Time of Transmission	Type of Transmission
DAYTON, OHIO			Central Time	
	Weather report	Fed.	11.30 a.m.	Phone.
Rike-Kumler Co.	Entertainment and news	Local	9.00 a.m.	"
	Entertainment and news	"	11.00 a.m.	"
WFO	Market report and weather	Fed.		"
	News and entertainment, Mon., Wed.	Local	4.00 p.m.	"
	News and entertainment, Thurs.	"	7.00 p.m.	"
DENVER, COLO.			Mountain Time	
Reynolds Radio Co. KLZ	Information not available			Phone.
DETROIT, MICH.			Central Time	
Detroit Free Press WCX	Information not available			Phone.
DETROIT, MICH.			Central Time	
	Entertainment, etc	Local	9.30 a.m.	Phone.
The Detroit News	Weather report	Fed.	10.15 a	"
	U. S. Time Signals	"	11.55 a	"
WWJ	Entertainment	Local	12.05 p.m.	"
	Market quotations	"	3.30 p.m.	"
	Weather report	Fed.	4.05 p.m.	"
	Sport and world news	Local	5.00 p.m.	"
	Entertainment	"	7.00 p.m.	"
EL DORADO, KAN.			Central Time	
	Weather and market report	Fed.	10.30 a.m.	Phone.
MidlandRefining Co.	Market report	"	1.30 p.m.	"
	Weather report	"	3.30 p.m.	"
WAH	Entertainment	Local		"
	Market report (Saturday)	Fed.	1.00 p.m.	"
ELKO, NEVADA			Pacific Time	
Air Mail Radio Station	Live stock receipts (code)	Fed.	8.30 a.m.	3000 arc
	Live stock Chicago (code)	"	12.00 noon	Undamped.
KDEJ	Live stock Chicago (code)	"	4.00 p.m.	"
FORT WORTH, TEXAS			Central Time	
	Weather report	Fed.	11.30 a.m.	Phone.
Fort Worth Record	Weather report	"	2.30 p.m.	"
	Market report	"	4.00 p.m.	"
WPA	Ball scores and news	Local	6.00 p.m.	"
	Entertainment	"	7.30 p.m.	"
	News and weather reports	"	10.00 p.m.	"
FORT WORTH, TEXAS			Central Time	Phone.
	Produce, grain and cotton opening	Fed.	8.45 a.m.	"
THE STAR-TELEGRAM	Weather report (code)	"	11.00 a.m.	"
	Cotton, grain, sugar and cattle report (code)	Local	2.00 p.m.	"
WBAP	Fort Worth cash grain	"	3.30 p.m.	"
GREAT LAKES, ILL.			Central Time	
(Chicago, Ill.)	Live stock receipts (code)	Fed.	8.00 a.m.	Telegraph
	Hog market flash, Chicago	"	8.50 a.m.	4900 meters
	Weather forecast	"	9.00 a.m.	continuous.
	Hog flash 5 or more markets	"	10.00 a.m.	Wave transmission.
	Fruit and vegetable shipments and shipping point information	"	10.10 a.m.	"
Navy Radio Station	Dairy products, market report New York and Chicago	"	10.40 a.m.	"
	Live stock market reports:			
	Chicago	"	11.15 a.m.	"
	Kansas City	"	11.25 a.m.	"
NAJ	St. Louis	"	11.40 a.m.	"
	St. Paul	"	*12.00 noon	"
	Omaha	"	*12.20 p.m.	"
	Chicago, close code advance estimate	"	*12.40 p.m.	"
	Grain report (code)	"	*1.45 p.m.	"
	Fruit and vegetable market report	"	*2.30 p.m.	"
	Hay and feed market report	"	*3.45 p.m.	"
	Dairy and poultry market report	"	*5.00 p.m.	"
	Daily marketgram	"	*6.00 p.m.	"
	Weather forecast	"	9.30 p.m.	"
HUTCHINSON, MINN.			Central Time	
Hutchinson Elect. Service Company	Weather and market reports as transmitted by University of			
WFAN	Minnesota	State	1.00 p.m.	Phone.
JACKSONVILLE, FLA.			Eastern Time	
Florida Times Union	Information not available			Phone.
WDAL				
JEFFERSON CITY, MO.			Central Time	
	Market reports, estimated receipts Kansas City, St. Louis and Chicago	Fed. and State	9.30 a.m.	Phone.
Missouri State	Hog opening and Kansas City grain (code)	"	"	"
Marketing Bureau	Kansas City and St. Louis live stock and Kansas City grain	"	11.30 a.m.	"
	Chicago butter and eggs, St. Louis potatoes and Kansas City grain (code)	"	2.00 p.m.	"
WOS	"Marketgram" general market information (daily except Tuesdays and holidays)	"	*5.00 p.m.	"
KANSAS CITY, MO.			Central Time	
Kansas City Star	Information not available			Phone.
KANSAS CITY, MO.			Central Time	
Daily Drovers Journal	Information not available			Phone.

Name and Call. Letters of Station	Nature of Reports	Source	Time of Transmission	Type of Transmission
KANSAS CITY, MO. Sweeney Radio Elect. Company WHB	Grain market reports for the Kansas City Board of Trade (half hour schedule)	Local	Central Time 9.30 a.m. to 12.30 p.m.	Phone.
KANSAS CITY, MO. Western Radio Co. WOQ	Hog report	Fed.	Central Time 9.45 a.m.	Phone.
	Live stock, Kansas City (code)	"	11.30 a.m.	"
	Fruit and vegetable	"	11.40 a.m.	"
	Grain report (code)	"	2.00 p.m.	"
	Live stock, Kansas City (code)	"	2.10 p.m.	"
	Live stock, Chicago (code)	"	2.20 p.m.	"
	Fruit and vegetable, Kansas City, Chicago and St. Louis	"	2.30 p.m.	"
	Repeat the 2.00 and 2.30 p.m. reports	"	7.30 p.m.	"
LINCOLN, NEBR. University of Nebr. WFAV	Omaha hogs and sheep, and grain report for Chicago, Omaha and Kansas City	Fed.	Central Time 10.10 a.m.	Phone.
	Weather forecast Nebraska	"		"
LOS ANGELES, CAL. Leo J. Meyberg Co. KYJ	Weather forecast	Fed.	Pacific Time 9.00 a.m.	Phone.
	Lectures University of Southern California	Local	2.30 p.m.	"
	Stock Exchange report	"	4.00 p.m.	"
	Music and entertainment	"	4.00 p.m.	"
MADISON, WIS. University of Wisconsin WHA	Chicago, potatoes, hogs, cattle, sheep, eggs, butter, cheese, poultry and hay (code)	Fed.	Central Time 12.00 noon	Teleg.
	Weather for Wisconsin	"	12.20 p.m.	"
	Weather same as at 12.20 p.m.	"	12.25 p.m.	Phone.
	U. S. time signal	"	12.59 p.m.	"
MANHATTAN, KAN. Kansas State Agricultural College WTG	Weather forecast	Fed.	Central Time 9.55 a.m.	Phone.
MEMPHIS, TENN. Reichman-Crosby Co. WKN	Weather and opening cotton market	Fed.	Central Time 11.45 a.m.	Phone.
	Close on cotton, live stock and produce	"	2.30 p.m.	"
	Baseball news	Local	6.00 p.m.	"
	Entertainment	"	8.15 p.m.	"
	Sermons (Sunday)	"	11.00 a.m.	"
MILWAUKEE, WIS. Gimbel Brothers Dept. Store WAAK	Market quotations of Milwaukee Chamber of Commerce	Local	Daylight Saving Central Time 10.00, 11.00, 12.10 and 1.25	Phone.
	Weather forecast (Wisconsin)	Fed.	11.00 a.m.	"
MINNEAPOLIS, MINN. University of Minnesota WLB	Weather report, Minneapolis, Wisconsin, North Dakota, South Dakota and Montana	Local	Central Time 12.00 noon	Telegraph and followed by Phone.
	St. Paul live stock summary of morning's market	State and Fed.	12.00 noon	"
	Minneapolis wheat closing, cash and futures, Minneapolis and St. Paul potatoes, summary	Local and Fed.	7.30 p.m.	"
MOBILE, ALA. Mobile Radio Co. WEAP	Information not available		Central Time	Phone.
NEWARK N. J. Westinghouse Elect. & Mfg. Co. WJZ	Market reports, New York City wholesale fruit and vegetable	State	Eastern Time 12.00 noon	Phone.
	New York City wholesale fruit and vegetable, eggs, hay, butter, etc	"	6.00 p.m.	"
NORTH PLATTE, NEBR. Air Mail Radio Station KDHM	Live stock receipts (code)	Fed.	Central Time 9.30 a.m.	Telegraph
	Live stock, Chicago (code)	"	12.00 noon	4000 meters
	Live stock, Chicago (code)	"	5.00 p.m.	arc
	Live stock, Kansas City	"	8.00 p.m.	undamped
	Live stock, Omaha, Nebr.	"	8.30 p.m.	"
OMAHA, NEBR. Air Mail Radio Station KDEF	Live stock receipts (code)	Fed.	Central Time 9.00 a.m.	Telegraph
	Live stock, Chicago (code)	"	11.00 a.m.	2500 meters
	Live stock, Omaha (code)	"	12.00 noon	arc
	Live stock, Kansas City (code)	"	1.00 p.m.	undamped
	Grain, Omaha (code)	"	2.00 p.m.	"
	Live stock, Chicago	"	4.30 p.m.	"
	Live stock, Kansas City	"	7.00 p.m.	"
	Live stock, Omaha	"	7.30 p.m.	"
PITTSBURGH, PA. (East) Pittsburgh Westinghouse Elect. Mfg. Company KDKA	Fruit and vegetable (Pittsburgh)		Eastern Time	
	Live stock (Chicago) grain	Fed.	7.45 p.m.	Phone.
	Chicago, hay and feed	Local	7.45 p.m.	"
RENO, NEVADA Air Mail Radio Station KDEK	Live stock receipts (code)	Fed.	Pacific Time 9.00 a.m.	Telegraph
	Live stock, Chicago (code)	"	1.00 p.m.	3200 meters arc undamped.

Name and Call. Letters of Station	Nature of Reports	Source	Time of Transmission	Type of Transmission
RICHMOND, IND. Palladium Printing Company WOZ	Indianapolis markets	Local	Central Time 12.00 noon	Phone.
	Weather forecast	Fed.	4.00 p.m.	"
	Complete market report	Local	4.00 p.m.	"
	Weather, local news, music	Fed. and Local	6.30 p.m.	"
ROCHESTER, N. Y. Rochester Times Union WHQ	New York State market reports	State	Eastern Time 7.45 p.m.	Phone.
ROCK SPRINGS, WYO. Air Mail Radio Station KDHN	Live stock receipts (code)	Fed.	Mountain Time 9.00 a.m.	Telegraph
	Live stock, Chicago (code)	"	12.00 noon	3000 meters
	Live stock, Chicago	"	4.30 p.m.	arc
	Live stock, Kansas City	"	8.00 p.m.	undamped
	Live stock, Omaha	"	8.30 p.m.	"
ROSWELL, N. M. Roswell Public Service Co. KNJ	Information not available		Mountain Time	Phone.
SAN FRANCISCO, CALIF. Leo J. Meyberg Co. KDN	Information not available		Pacific Time	Phone.
SCHENECTADY N. Y. General Electric Company WGY	New York City market, fruit and vegetable, butter, eggs, poultry, hay and country dressed meat	State	Eastern Time 7.00 p.m.	Phone.
ST. LOUIS, MO. St. Louis University WEW	Market report, Live Stock receipts, St. Louis & Chicago hog opening. (Code)	Fed.	Central Time 10.15 a.m.	Phone
	St. Louis and K. C. opening trend of Market, Liverpool cables	"	10.15 a.m.	"
	Fruit & Vegetable, Chicago potatoes, Live Stock, St. L. close, closing grain market	"	2.15 p.m.	"
	Market reports Saturday	"	1.00 p.m.	"
ST. LOUIS, MO. Stix-Baer & Fuller Co. WCK	Merchants Exchange reports opening future market	Local	Central Time 8.40 a.m.	Phone
	Future market receipts and shipments	"	9.40 a.m.	"
	Future market	"	10.40 a.m.	"
	Future market	"	11.40 a.m.	"
	Closing future market			
	Cash grain prices	"	12.40 p.m.	"
SPRINGFIELD, MASS. Westinghouse Elec. & Mfg. Co. WBZ	Weather forecast	Fed.	Eastern Time	Phone
	Mass. state market reports	State	.....	"
STATE COLLEGE, N. M. N. M. College of Agri. & Mechanical Arts KOB	Time signals	Fed.	Mountain Time 11.55 a.m.	Phone
	Weather forecast	"	12.00 Noon	"
	Crop reports	"	12.05 p.m.	"
	Music and entertainment	Local	8.00 p.m.	"
TAMPA, FLA. Tampa Daily Times WDAE	Information not available		Eastern Time	Phone
TOLEDO, OHIO The William B. Duck Co. WHU	Grain market (Toledo)	State	Eastern Time 9.40, 12.30 and 1.40	Phone
	Live stock and vegetables	"	12.30 p.m.	"
	Baseball and news	"	5.00 p.m.	"
	Musical entertainment Tues. and Thurs	Local	9.00 p.m.	"
TULSA, OKLA. Midland Refining Co. WAH	Live stock reports	Fed.	Central Time 10.30 and 1.30	Phone
	Weather forecast	"	10.30 and 3.30	"
	Concerts (not regular)	Local	7.45 p.m.	"
UNIVERSITY PLACE, NEBR. Nebraska Wesleyan University WCAJ	Weather forecast and news	Fed. and Local	Central Time 8.50 a.m.	Phone
	Omaha live stock, Chicago grain (code and press)	Fed.	4.00 daily 12.15 Sat.	"
	Concerts, lectures, etc., Tues. and Thur	Local	9.30 p.m.	"
WASHINGTON, D. C. Post Office Dept. Air Mail Radio Station WWX	Fruit and vegetable (Wash., D. C.)	Fed.	Eastern Time 10.30 a.m.	Phone 1160 meters meters
	Live stock receipts and St. Louis and Chicago hog opening. (code)	"	12.30 p.m.	"
	*Live stock, Chicago and St. Louis. Code (close)	"	2.15 p.m.	"
	*Crop reports and special market news	"	3.00 p.m.	"
	*General fruits and vegetables	"	3.30 p.m.	"
	*Dairy products New York and Chicago (code)	"	5.00 p.m.	"
	*Grain	"	5.30 p.m.	"
	*Live stock and grain (code)	"	7.30 p.m.	"
	*Fruit and vegetable	"	8.00 p.m.	"
WICHITA, KAN. The Cosradio Co. WEY	Board of Trade reports		Central Time	Phone
	Information not available			

*Not broadcasting on Saturdays from June 15 to September 15.

14 YEARS *of* KNOWING HOW

IT IS gratifying that Murdock apparatus has attained an even higher prestige in radio than we dared expect.

Fourteen years of *good* designing and *good* manufacture has convinced most users of radio apparatus that solid integrity on the part of the manufacturer is better than an oversupply of questionable apparatus.

PRICES:

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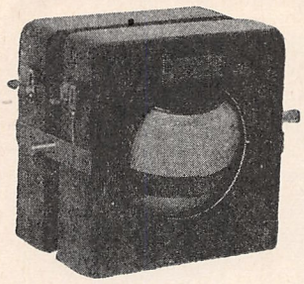
WM. J. MURDOCK CO., 344 Washington St., Chelsea, Mass.

MONARCH VARIOMETERS



Solid Mahogany Rotor and Stators. Perfect Windings. Wood thoroughly seasoned and Kiln Dried. No warped wood and loose coils. Beautiful Mahogany Finish. Minimum Air Gap. Acute Tuning. Adjustable Spring Bearings. Patented Brass Clips.
Wave length, 150 to 600 Meters...**$5.75**

Monarch Poplar Variometer exactly the same as above in Poplar Wood....**$5.00**

Monrad Variometer. An innovation in Radio. An absolutely perfect variometer in every way and carrying the same guarantee as the above Monarch Variometers **$3.00**

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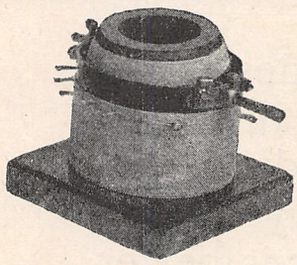

Composition Tube. Mahogany Rotor and Base. Thoroughly seasoned, Kiln Dried. Primary coil, fifty-five turns, seven taps of seven turns and six single taps, insuring very sharp tuning. Adjustable Spring Contact. An absolutely 100 per cent. perfect Variocoupler **$5.75**

Monarch Poplar Variocoupler exactly the same as the Mahogany instrument above, only in Poplar wood.....**$5.00**

Monrad Variocoupler. To match the Monrad Variometer.
100 per cent. perfect **$3.00**

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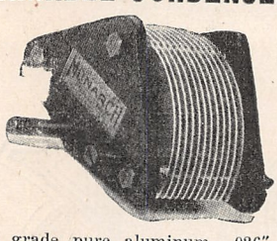

High grade pure aluminum, .026" sheet. Much heavier than generally used. Large fiber insulating plates at each end. Turned Brass Washers. Carefully planished to an exact thickness.

43 Plate.....**$3.50**
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Each and every Monarch instrument carries an absolute 100 per cent. electrical and mechanical guarantee

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Book Review

HANDBUCH DER DRAHTLOSEN TELEGRAPHIE UND TELEPHONIE. By Dr. Eugen Nesper. 2 volumes, 10" x 6½", cloth covered. Volume 1, 708 pages. Volume 2, 545 pages; 1,321 illustrations, photographs and diagrams. Published by Julius Springer, Berlin.

This work is one of the most comprehensive of the modern treatises. The numerous illustrations are accompanied by descriptions of every conceivable apparatus used in radio communication, past or present. The historical record is very complete and traces the development of radio telegraphy and telephony from the very earliest days.

In typical German style, two very excellent tables of literal and graphic symbols are given before the text opens, while two lengthy and complete indexes, one of apparatus and the other of names, are included at the end of the second volume.

The work opens with a discussion of the various uses and applications of radio in peace and in war. In the first chapter are also given a general description and analogies of the phenomena involved in radio communication.

The historical record is contained in chapter 2 and commences with the early experiment of Galvani. The various contributions to the development of the art are recorded and discussed in proportion to their significance. This chapter also describes the types of apparatus used by the inventors and explains how they were employed. Information is given concerning methods of transmission, damped and undamped, including arcs, vacuum tubes and various spark producers. Methods of reception are also discussed.

Coupling, damping and all the most recent developments with each author's and inventor's name are given in full detail. Two chapters are devoted to the subject of high frequency currents. The operation of high frequency measuring instruments is explained and oscillographs and calculations given for many experiments.

The second volume commences with a description of transmitting apparatus with full elements of construction including different styles of generators. A very interesting portion is devoted to the manufacture of vacuum tubes. The minutest details are given of the various parts. Condensers are treated from the beginning. Inductance is treated with great fullness. There is also a very full discussion of insulators, together with antennae and antenna masts. All types of detectors from coherers to vacuum tubes are fully explained. Amplifiers and loud speakers are also treated.

One chapter describes stations in general in war and commerce. The use of wireless by railroads is given a chapter and another is devoted to the subject of radio telephony. A final chapter discusses the subject of patents.

RADIO-TELEPHONY FOR EVERYBODY. By Laurence M. Cockaday. Cloth covers, 5" x 7½", 212 pages. Illustrations and Diagrams. Published by Frederick A. Stokes Company, New York.

Elementary work which touches lightly upon the general theory of radio-telephony. By means of some photographs and diagrams, it indicates the types of apparatus used in transmitting and receiving. Detection and regeneration are explained in simple language; practical information is given on the construction of a transmitter and the construction of a receiver. It concludes with a chapter on care and maintenance; good reading for the beginner.

THE COMPLETE RADIO BOOK. By Raymond Francis Yates and Louis Gerard Pacent. Cloth covers, 5" x 7½", 327 pages. Illustrations and Diagrams. Published by the Century Company, New York.

An unusual book written for the beginner in radio or those who have an interest in the subject but an absence of knowledge concerning it. The book will probably be read by some who would, in the ordinary way, abhor any form of text-book. It commences with a short history of communication with pictures of South American savages beating hollow logs and progresses to slightly more modern methods of communication. Subsequent chapters treat the various applications of radio in an interesting manner, and smatterings of theoretical explanation are surreptitiously inserted. The book will prove unusually interesting to the public interested in radio.

RADIO FOR THE AMATEUR. By A. H. Packer and R. R. Haugh. 5" x 7½", 207 pages. Illustrations and Diagrams. Published by the Goodheart-Willcox Company, Chicago.

Very elementary; written in a series of messages, conveying the principles of radio. Also gives instructions for the construction of some simple apparatus.

ELEMENTS OF RADIO TELEPHONY. By William C. Ballard, Jr. Imitation leather covers, 5" x 7½". Illustrations and Diagrams. 132 pages. Published by McGraw-Hill Company, New York.

Presents in simplified form a brief description of what happens when messages are sent and received by radio. The apparatus required to produce these effects is described and the method of its operation. A fairly complete elementary description of vacuum tubes and their circuits is given.

RADIO FOR EVERYBODY. By Austin C. Lescarboura. Cloth covers, 5" x 7½", 334 pages. Illustrations and Diagrams. Published by the Scientific American Publishing Company, New York.

Written for the layman who does not regard radio as an engineering study but as a means of amusement and possible instruction. Provides him with an intelligent understanding of the principles of radio and the methods of procedure in obtaining results.

Interdepartment Advisory Committee on Governmental Radio Broadcasting

At the request of the Secretary of Commerce each of the ten Government Departments has appointed representatives on an Interdepartment Advisory Committee on Governmental Radio Broadcasting. In addition there are representatives of the Office of the Chief Coordinator (Bureau of the Budget), and the U. S. Shipping Board. The membership of the Committee is as follows:

Agriculture—W. A. Wheeler, Radio Development Section.

Commerce—Dr. S. W. Stratton, Director, Bureau of Standards.

Interior—O. P. Hood, Chief Mechanical Engineer, Bureau of Mines.

Justice—S. Ely, Chief Clerk.

Labor—A. E. Cook, Office of the Secretary.

Navy—Com. B. C. Bingham, Naval Communication Service.

Post Office—J. C. Edgerton, Air Mail Division.

State—W. S. Rogers, International Communications Conference.

Treasury—L. J. Heath, Public Health Service.

War—Maj.-Gen. G. O. Squier, Chief Signal Officer.

Chief Coordinator—Capt. H. P. Perrill, Assistant Coordinator, Bureau of the Budget.

U. S. Shipping Board Emergency Fleet Corporation—F. P. Guthrie, Head of Radio Division, Operating Department.

The Chairman of the Committee is Dr. S. W. Stratton, and the Secretary is Dr. J. H. Dellinger, Chief of the Radio Laboratory, Bureau of Standards, Department of Commerce.

In accordance with recommendations of the Committee, an experimental system of Government broadcasting by "primary" broadcast stations has been established, utilizing only previously existing Government stations and equipment. The "primary" stations are stations which broadcast official Government news by continuous-wave (code) telegraphy for the purpose of furnishing this information to local broadcast stations for rebroadcasting by radiophone. The eight stations thus far included send out daily bulletins of Government news, mostly agricultural

Type R Z Radak Receiving Set, Clapp Eastham's newest achievement.
(***Licensed under Armstrong*** *U.S. Pat. 1,113,149)*

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CLAPP-EASTHAM'S long career in engineering and manufacturing has been devoted to Radio exclusively. In all those years its single aim has been to make Radio simple and easy for the novice. In the Type R Z Radak Receiving Set shown above the very highest development of this aim has been realized.

This new set brings in signals, messages and music with amazing clearness and loudness, responding to wave lengths as great as 3,000 meters. Especially when used with the Radak Electro Amplifone, the effects obtained are unsurpassed by any set made today, whatever the price.

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Cabinet: Solid mahogany, dull finish. Hinged cover. Compartment for B battery.
Panel: Condensite, dull finish black; white lettering.
Dials: Indestructible metal, black with white lettering.
Binding Posts: Hard rubber composition.
Condensers: Balanced type, built as a Vernier; two rotary, three stationary plates.
Antenna Inductance: Wound on formica tube.
Plate Inductance: Wound on molded ball.
Switch: Fan blade.
Rheostat: Clapp-Eastham type H-400.
Circuit: Single circuit regenerative.
Price: $100, complete as above.

Ask to see this unusual set at the store where you usually buy electrical goods. If the dealer does not carry the Clapp-Eastham line, he may obtain same through his jobber.

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"When one can get Washington, NOF, Public Health Service, hear clearly an address of the Medical Inspection of School Children of the United States, followed by an address on Radio As Applied to Government Work; then tune in on Pittsburgh for a musical programme only; to be entertained by an eloquent address by the Rev. Mitchell of Minneapolis at McCreas' Dining Rooms in Pittsburgh; tune in on Newark, N. J., to hear a final musical number from that station; together with jumps to Springfield, Mass.—*four distinct messages in the air at one time but each tuned in clearly as occasion demanded* —one can say, why are you not satisfied?

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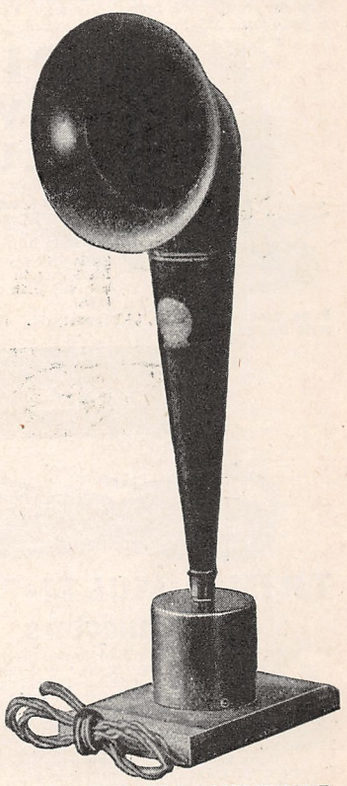

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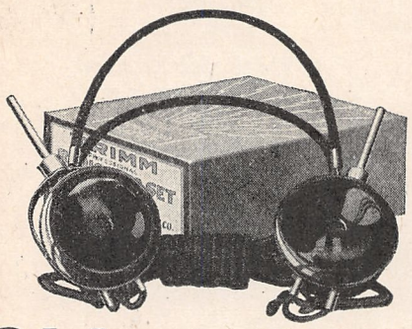

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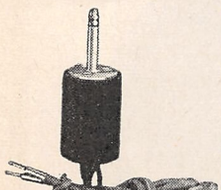
At last! Perfect reproduction and articulation at any range with the new approved TRIMM professional Head Set. Designed and built expressly for radio work by highly skilled experts of long experience.

One-piece magnet formed (not punched) guarantees uniform tempering and magnetizing. Cases and caps made entirely of high-grade Phenol compound, free from sulphur and corrosive gases; odorless and warp-proof. New type head band insures perfect comfort.

Special Introductory Price only $10.00, with privilege of five days trial. We prepay charges. Your money back if you return it. See below how to order.



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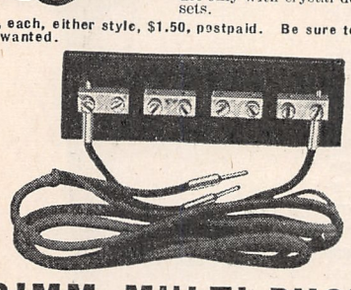
Style "A" for connecting two head sets in series. Intended expressly for and the only correct plug for use with lamp (vacuum tube) detector sets.

Style "B" for connecting two head sets in multiple. For use only with crystal detector sets.

Price, each, either style, $1.50, postpaid. Be sure to state style wanted.



TRIMM MULTI-PHONE Connectors

For connecting 2, 3, 4, or 5 additional head sets to audion tube or crystal detectors. Type "A" (illustrated above) for connecting head sets in series—the only proper method for lamp detector sets. Does not diminish the sound or tone by dividing it between the extra head sets. Type "B" (not illustrated) for connecting head sets in multiple—the only proper method for crystal receiving sets.
Prices: For 2 head sets, $1.00; for 3 head sets $1.25
For 4 head sets, $1.50; for 5 head sets $1.75
Order any TRIMM product on 5 days trial. Your money back if you return it. We ship direct or through your dealer. Write for folder. Or mail your order at our risk.

DEALERS: Trimm Radio specialties have no real competition. Our wholesale and retail distributors are fully protected. Write for quantity discounts and full particulars. We ship your first order on approval.

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Dept. 11, 24-30 S. Clinton St., Chicago

market data. They are: Arlington, Va. (Navy, 5,950 meters); Great Lakes, Ill. (Navy, 4,900 meters); Washington, D. C. (Post Office, 1,980 meters); Omaha, Neb. (Post Office, 2,500 meters); North Platte, Neb. (Post Office, 4,000 meters); Rock Springs, Wyo. (Post Office, 3,000 meters); Elko, Nev. (Post Office, 3,000 meters); Reno, Nev. (Post Office, 3,200 meters).

The Committee has made a preliminary classification of the kinds of material which the several departments may have to broadcast by the primary stations, viz., market prices and data, weather and hydrographic news, standard radio signals (such as wavelength and time signals), executive announcements, statistics, and educational material. One of the functions of the Committee is to advise regarding priority of the types of Government material to be broadcasted and regarding schedules of operation.

The Committee has recognized the principle that radio must be used primarily for types of service that cannot be as satisfactorily given by other means of communication, and that therefore radio broadcasting should not be used in general where wire telegraphy or telephony or printed publication would be as satisfactory. It is possible that the scope of the Committee's activities may be extended beyond the subject of broadcasting, and that the Committee will act in an advisory capacity to the Secretary of Commerce in matters of Government radio regulation and will consider all radio questions of interdepartmental interest.

The Three Summer-Time Radio Imps

DON'T be surprised this summer if your new radio receiving set gives forth a first class imitation of a boiler shop in full operation instead of an anticipated lecture on the culture of silk worms, said the Bureau of Standards of the Department of Commerce in announcing that the "bad radio weather" season was on.

According to the Bureau of Standards these summer disturbances, called "strays," "static," "atmospheric," and other names, are in evidence from about April 1 to October 1. Their seriousness varies from weak interference for brief intervals to a continuous succession of boiler-shop noises which may last throughout the night.

A great deal of work has been done by radio engineers and scientists in an effort to reduce the interfering noise caused by these strays. At important government and commercial stations certain devices and methods are in use by means of which strays are considerably reduced, and it is made possible to obtain fairly reliable reception during the summer. The apparatus and methods now employed at such stations are usually too elaborate to be used at the ordinary amateur station. One method which the amateur will find helpful in reducing certain types of strays is the use, instead of the usual elevated antenna, of a coil antenna and a more sensitive receiving set. A coil antenna may be constructed by winding a suitable number of turns of wire with proper spacing on a wooden frame about 4′ square. Certain types of strays seem to come from a particular direction. Many strays however have no directional properties, including those due to local electric storms. The coil antenna has the property of receiving a stronger signal when pointed in the direction from which the signal is approaching, and receiving only a weak signal when pointed at right angles to that direction. Thus by rotating a coil antenna to the proper position the directional types of strays can be greatly reduced and a better ratio of signal to strays will be obtained. The ordinary elevated antenna does not possess marked directional properties, and therefore cannot be used like the coil antenna for stray elimination. However, the strength of signal picked up by a coil antenna is much smaller than the strength of signal picked up by the ordinary elevated antenna, and good results should not be expected from a coil antenna unless three or more stages of amplification are used.

Some relief can also be obtained by persons having good amplifiers by using a "ground antenna." This is a long insulated wire run in a shallow trench or on the surface of the ground. The ground wire should be run in the direction of the station from which the most signals are to be received, and should preferably be several hundred feet long.

Through strays of given intensity, better results can be obtained in receiving strong signals than weak signals. Nearby stations can be received much better through the strays than distant stations. It is therefore fortunate that broadcasting stations are being established at a considerable number of different cities located in all parts of the United States, so that for most parts of the country there is a broadcasting station from which fair reception can be expected even when strays of moderate intensity exist. In the summer a person must be content with weaker signals and should use less amplification than in the winter, since the strays are amplified as well as the signals. If considerable amplification is used, strong stray disturbances will produce noises in the telephone receivers which are very unpleasant and make it almost impossible for an operator to keep the telephone receivers on the head for any considerable length of time.

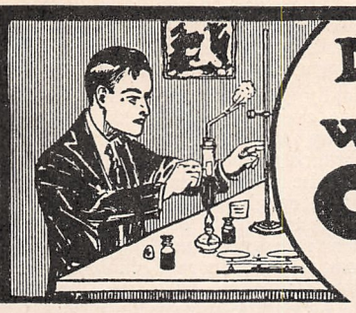
Pop Takes Up Radio

By E. J. GUILLEMETTE

MY pop's a great mechanical man; he builds machines to beat the band; so when Radiophones began to sing, pop listens to one and said, "By jing, I'll build me one of those there sets and hear some music you can bet." So pop he starts right in to write a list of things to buy next night. Home he comes with wire by the spool; maw grins and says, "Don't be a fool;" but pop, he glares and wants to know who foots the bills for all the shows. He says he's trying to save expense—to keep us home and teach us sense; bring classic music to our home; let us hear grand opera sung in Rome. So maw she lets it all pass by while pop with an oats box begins to try to wind his wire so it will stick one on top of the other; he reaches quick for some shellac to hold the strand before it slips from his other hand.

First night his patience held out fine. He never "cussed," a single time. His coil, he called it, looked quite neat. 'Twas green as grass beneath your feet. Maw says, "What harmony;" Pop says, "Where," but maw just snickered while pop just glared.

Next night he brings some aluminum sheets. "Condensers," pop says, as maw's gaze he meets. This time maw never says a thing; just sighs and looks at her wedding ring. That night pop worked till one o'clock getting his plates so they would rock in and out and all around without touching each other or making a sound. He finally gave up and went to bed. Next morning his eyes were sleepy and red, but when he came home from work that night, he rolled up his sleeves and took up the fight and just as he got the condenser to go it slipped and fell to the floor below. I always sus-



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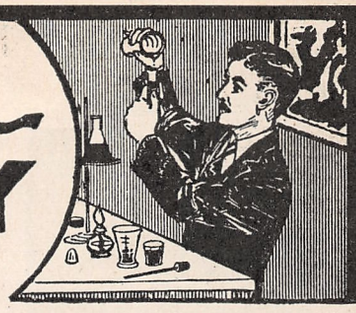

Good Chemists Command High Salaries

DR. T. O'CONOR SLOANE, A.B., A.M., LL.D., Ph.D.
Noted Instructor, Lecturer and Author. Formerly Treasurer American Chemical Society and a practical chemist with many well known achievements to his credit. Not only has Dr. Sloane taught chemistry in the class-room but he was for many years engaged in commercial chemistry work.

Industrial firms of all kinds pay tempting salaries to get the right men. Salaries of $10,000 to $12,000 a year are not unusual for chemists of exceptional abilities. Chemistry offers those who are ambitious and willing to apply themselves conscientiously the greatest opportunities of any vocation. Why be satisfied with small pay and hard, thankless work—learn the profession of Chemistry and your salary will depend only upon your own efforts and your own abilities.

The work of the chemist is extremely interesting. If you are fond of experimenting, if you like exciting and intensely interesting work, take up Chemistry. To the man who is dissatisfied with his present job, to the young man just deciding on his life work, Chemistry holds alluring charms, and countless opportunities. If you want to earn more money, the way is open through our course in Chemistry.

Now Is The Time To Study Chemistry

Never before has the world seen such splendid opportunities for chemists as exist today. The war has awakened the United States to the need of trained chemists and chemical engineers. Everywhere the demand has sprung up. In factories, mills, laboratories, electrical shops, industrial plants of all kinds, chemistry plays a vital part in the continuation and expansion of the business. In every branch of human endeavor the need for chemists has arisen. No profession offers such alluring opportunities and the next ten years are going to show the greatest development in this science that this country has ever seen. Those who have the foresight and ambition to learn chemistry now will have the added advantages and greater opportunities afforded while the chemical field is growing and expanding.

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From Hudson Maxim,

"Dr. Sloane has done a much-needed work in a much better way than anything of the kind has, heretofore, been done.

"Dr. Sloane has a remarkable faculty of presenting Science for self-instruction of the student in such a clear and understandable way as to be most readily grasped and assimilated.

"I, therefore, unreservedly recommend and place my highest indorsement on his work."

From Dr. W. W. de Kerlor,

"I can not recommend your course too highly and I congratulate both you and Dr. Sloane on same."

From John A. Tennant,

"This is something which has long been needed. Your long experience in the teaching of chemistry . . . assurance that the course will be practical as well as plain to the untrained students."

What the Students Say:

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"This is just like reading some fascinating fiction story."

"I have just been made Assistant Chemist of my concern."

"Your course is just what a person wants to start in the wonderful science of Chemistry."

"I find that your course is very interesting. I wait patiently for the next lesson."

"I find the study of chemistry more and more interesting at every lesson and you may be sure that I am getting into studying habit even more than I ever did even in my school days."

"I am well pleased with your course and I think, from the way it starts out, I have found a good teacher and school."

"Your course is sure wonderful, easy to understand, and so well laid out. I like it immensely."

"The lessons are fine and I like them."

"I have written to different people about your course and they speak very highly of same."

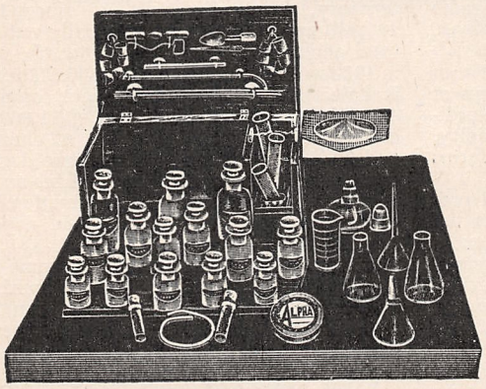
"If I don't learn it isn't your fault for I find that your lessons contain a whole lot."

(Names and addresses on request)

You Can Learn At Home

Dr. Sloane will teach you Chemistry in a practical and intensely interesting way. Our home study course written by Dr. Sloane himself is practical, logical and remarkably simple. It is illustrated by so many experiments that are performed right from the start that anyone, no matter how little education he may have, can thoroughly understand every lesson. Dr. Sloane teaches you in your own home with the same individual and painstaking care with which he has already taught thousands in the class room. And, Dr. Sloane personally examines and corrects all examination papers, pointing out your mistakes and correcting them for you. He will, in addition, give you any individual help you might need in your studies. This personal training will be of inestimable value to you in your future career.

Experimental Equipment Furnished to Every Student



We give to every student without additional charge, this chemical equipment including forty-two pieces of laboratory apparatus and supplies and eighteen different chemicals and reagents. The fitted heavy wooden box serves not only as a case for the outfit but also as a laboratory accessory for performing countless experiments. Full particulars about this special feature of our course are contained in our free book "Opportunities for Chemists."

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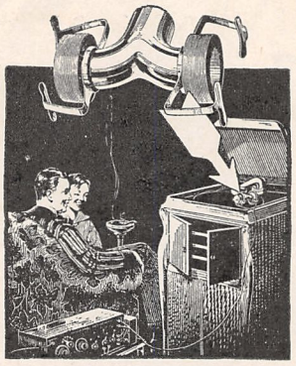

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Ekko connects your head phones with the tone arm of your phonograph, and transmits Concerts and Programs through the sound box.

The best Loud Speaker you can use—utilizes the scientific design of the phonograph sound box, produces a mellow, pure tone. If your dealer does not yet carry Ekko, use the coupon—send $3 and we will mail one immediately, post paid. Money back if not satisfied. Mention the make of your phonograph.

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_____

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pected pop could cuss, but maw chased me off so I missed the "wust." Pop picked it up and started again though now the clock said half past ten.

Night after night poor pop would sit before his set and weave and knit little wires from this to that, then back again with a poke or a pat. The gas was going every night. Pop soldered all joints to make them tight. A little lamp he finally bought; he called it detector and said it ought to bring in music from all around as soon as he gets his tickler wound.

On this tickler job pop laid great stress till baby made it a terrible mess. A little wood ball with wires stuck on appealed to baby's sense of fun. He rolled it round on the floor all day. When pop came home there's the deuce to pay. Poor maw she didn't know what it was. Baby said it came from Santa Claus. The edges got chipped; the wires got broke; pop got red in the face just like he'd choke. Finally he got it "fixed" once more; then he bought another one from the store.

His telephones came by parcel post. Pop cussed and says the plug was lost, so down to the store he hikes again though the wind blew hard and it pelted rain; for pop he is a determined guy when he starts a thing—it's do or die. He came back home wet to the skin. He was happy though for he'd also been to a battery store to get his "juice." Maw sighs and says. "Oh, what's the use?" The battery weighed 'bout a hundred pounds. Pop set it down, then beams around. "This little one, maw, is for the plate." Maw gasps, "Oh, my! do they cost by weight?" "Never mind," says pop, "I'll foot the bills. The music's worth it; you'll get some thrills when you hear my set in 'bout half an hour," and once more he sets out in the shower—this time, to put up his aerial wire—one end to the chimney—he couldn't climb higher. The other end was to go to a tree. Oh boy! but it was a sight to see pop heaving rocks with a string tied around, aiming for a crotch sixty feet from the ground. He pelted bricks for an hour or more. He'd be throwing them yet but his arm got sore.

He finally yelled to me, "Hey, Bobbie, come here and climb this pesky tree." I shinnied up and tied the string to the nearest branch to the top of the thing. Pop pulled in the slack from the other end, but the tree caught a breeze and began to bend. The string held out just about half way, then it snapped and pop cussed in great dismay. Once more I shinnied up the trunk. Pop claims the string must have been punk, so I tied the wire with maw's new clothes line. This time it held out and pop says, "Fine!"

Then he went in to hitch up the set. Pop was some happy and full of pep. He tied on the wires, put the telephones on, says, "Watch and listen now, my son." I listened and watched for an hour or more. The clock struck ten, then maw got sore. "Bobbie," says she, "has to go to school. He'll never wake up. Don't be such a fool. You'll never hear anything on that pile of junk; forget it and trot up to your bunk." When maw talks that way pop knows she's mad, so he gave up saying, "The ether's bad. Tomorrow night we'll try again. The set'll work better when it doesn't rain."

Well, we "listened in" for over a week, then pop hired an expert his trouble to seek. This expert turned out to be but a boy, but he got results to pop's great joy. First he cast his eagle eye around, then to pop says, "Mister, where's your ground?" Pop nearly fell over in surprise. His face turned red, he blinked his eyes. "I clean forgot it!" he blurted out. Maw hid her face and turned about. He hitched a wire to the water pipe. Pop listened again and says, "By Cripe! Hey, Maw, Chicago's playing here. Come listen to some music, dear."

Maw listened, then turned to pop quite spry, "You're kidding yourself, it's WGI."

Controlling Irrigation by Radio

Arizona Station to Broadcast Flood and Drought Warnings

RADIO control of an irrigation project comprising some 200,000 acres of reclaimed land in Arizona, is the latest use to which overworked radio has been put by the Government. The Salt River Valley Water Users' Association, which is a local agency controlling the Salt River Irrigation Project for the Interior Department, has installed and equipped a radio house toward the source of the Verde River, their natural water supply. There is no railroad or means of communication between Phœnix, Arizona, and the upper reaches of the river where sudden storms cause the ordinarily low water to rise with great rapidity, frequently flooding the ranches and farms below and causing enormous damage.

Believing that a radio service would provide a timely warning, the operators of the project have taken up the latest means of quick and direct communication, and received the approval of Secretary Fall of the Interior Department. Gauges are placed in the upper Verde and also at Cave Creek, so that any appreciable rise can be noted and broadcasted from the station to the manager's office in Phœnix and to all ranch owners who listen in.

There is also another phase of usefulness to the new radio station. When the Verde, which flows into the Salt River near Phœnix, is supplying plenty of water, only a little is used from the reservoir back of the big Roosevelt Dam, and in the future the inlet from the reservoir will be controlled by telephone from Phœnix based on reports from the radio station as to the state of the water in the Verde. When the storage water is not needed, or the radio station advises the operator at Phœnix that rain is falling in the Verde basin, the inlet to the system from the Roosevelt Dam will be closed and nature will take care of the irrigation; but when the Verde is low the inlet at the dam will be opened by telephone orders from Phœnix. This control will conserve considerable of the valuable storage supply for emergencies.

Some estimate of the project and its value may be gained when it is known that in this territory, practically built up since 1900, 196,350 acres are cropped annually out of a total acreage of 205,060, and that the crops in 1920 were valued at $18,551,800. The land included in the Salt River Project comprises 4,200 farms with a population of 31,600, includes 14 towns with 57 schools, 62 churches and 20 banks. During the past two decades the section has been transformed from an arid territory into a high state of cultivation. Its banks have gained $22,927,767 in deposits since 1920.

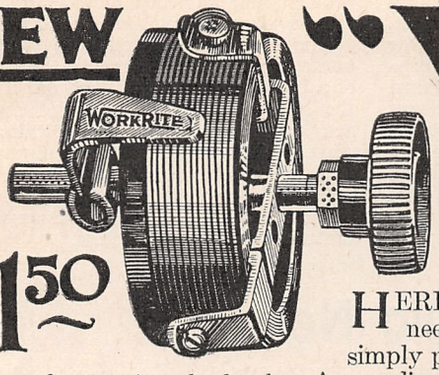
In the past there have been some bad years, when the water was short, but with the new radio control and communication it is believed that the water can be so conserved as to insure a steady and lasting supply.

RADIO MINE EQUIPMENT CONSIDERED

Another branch of the Interior Department, the Bureau of Mines, is seriously considering the problem of equipping mines with radio apparatus for use in the event of a cave-in or other accident. The stringing of wired telephone is impossible, but officials state that it would be fairly simple to equip certain distant rooms or chambers with crystal receiving sets so that rescue parties could communicate with imprisoned miners. The real problem, they say, is to find a simple and portable transmitting set by which the miners could communicate with the mouth of the

NEW "WORKRITE" SUPER RHEOSTAT

(PATENT APPLIED FOR)

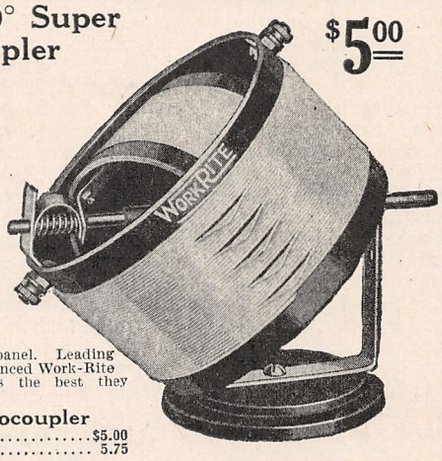


$1.50

HERE is a REAL Rheostat—something entirely new and very much needed. Can be instantly changed from 6½ ohms resistance to zero by simply pushing in the knob, or you can have fifty thousand different adjustments by turning the knob. Any radio man can appreciate what this means on a detector tube when working on DX signals or concerts. Many engineers claim the WorkRite Rheostat will double the efficiency of the set. All metal parts made from brass, nickeled and highly polished. The special resistance wire is non-corrosive, non-rusting and does not change in resistance through change in temperature. Screws for mounting on panel furnished. The WorkRite Rheostat is really remarkable in its performance and is easily worth twice the price asked. No set should be without it. Price.....**$1.50**

WorkRite 180° Super Variocoupler

$5.00

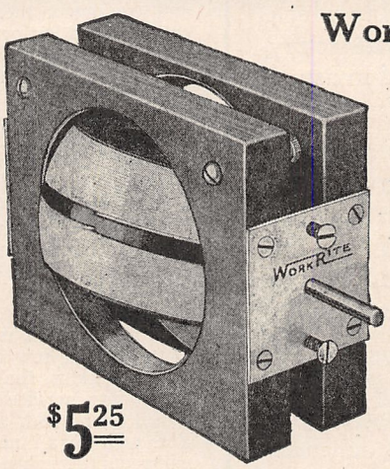


THE WORKRITE VARIOCOUPLER represents perfection in getting all dimensions and number of wire turns just right. Tunes twice as sharp as the ordinary 90° coupler. Most any coupler will work, but few will "WorkRite."
Both primary and secondary are made from Formica. Contacts are formed by double springs, eliminating scratching noises. All metal parts are made from highly polished brass and nickeled. Shaft 3/16". Easy to mount on panel. Leading radio engineers have pronounced Work-Rite Variometers and Couplers the best they have ever tested.

WorkRite Variocoupler

Packed in attractive box.....$5.00
With Dial..... 5.75

WorkRite Super Variometer



$5.25

THE WORKRITE VARIOMETER is made from finest quality mahogany and will not warp. Beautiful finish. Binding posts are placed between stators. Both connections made by double spring contacts. Has 3/16" shaft. All windings are perfectly made, and connections cleverly concealed. Easy to mount on panel with two screws furnished. All metal parts made from brass, highly polished and nickeled. Substantially built throughout. Just the right number of turns and air space to make it very sensitive and to tune extremely sharp.

WorkRite Variometer

Packed in attractive box.....$5.25
With Dial 6.00

Binding Posts and Switch Points

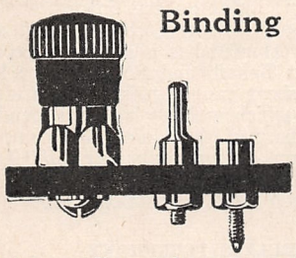
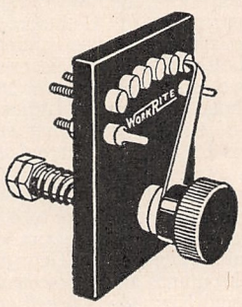


ILLUSTRATION shows actual sizes. Binding post has hard rubber top. All metal parts made from brass, nickel plated.

WorkRite Binding Posts.....10c
WorkRite Switch Points..... 3c
WorkRite Switch Stops..... 4c
WorkRite Switch Lever with Bushing.....40c

WorkRite Switch Set



JUST what you want! Remove parts and use the block for a template in drilling panel. Switch Arm and Points made to work together. Put up in neat individual boxes. Easy to sell.

Price Complete, 80c

WorkRite Type "A" Hydrometer

DOUBLE the life of your battery by giving it proper care. Fill and test it regularly with a WorkRite Hydrometer. Never let it become discharged below 1150, or it will soon be ruined. Full instructions for testing and care of battery with each "WORKRITE." Get one now!

Price **$1.00**

A THOUSAND DOLLAR SET or one made from cardboard tubes will more efficiently receive the broadcasted concerts if equipped with a new "WORKRITE" RHEOSTAT. Get one today and double the efficiency of your set.

RADIO FANS: Insist that your dealer furnishes genuine WorkRite Parts. Accept no substitutes. JOBBERS and DEALERS: Write or wire for discounts.

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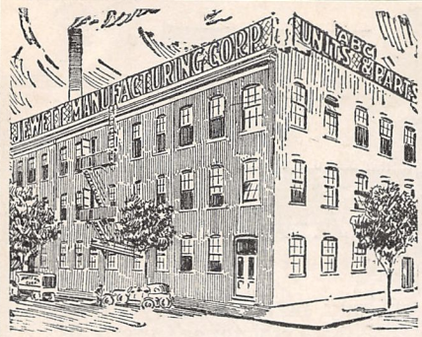


The plant of the Jewett Manufacturing Corp., in which ABC Units and Parts are produced, is among the very few well equipped factories devoted entirely to the manufacture of radio products.

ABC Parts
for Radio Receiving Sets

As the result of exceptional manufacturing facilities, ABC Parts possess an inbuilt quality, precision and stability which renders them most satisfactory and also economical in actual service.

Dependable parts are so essential to the construction or maintenance of a satisfactory receiving station that every effort should be made to use ABC Parts wherever possible.

The new catalog, "ABC Parts for a Radio Receiving Set", is a complete guide to the selection of correctly designed, carefully produced and attractively finished radio products. Send for a copy today.

ABC Parts can be obtained from thousands of good radio dealers throughout the country. If more convenient, order direct from the manufacturers.

A guide book to satisfactory Radio Parts. Send for free copy today.

Jewett Manufacturing Corp.
342 Madison Ave., Dept. R9
New York

mine or the outside world in the event of being injured in or imprisoned after an accident. There is no room for a large transmitting set, they point out, and the danger of a transmitting spark igniting gases or coal dust complicates the problem, although a tube set might be used if the necessary power could be supplied for its operation without lengthy power wires which would be in danger of being cut constantly, just as telephone lines would be cut or broken by the mining operations. Mining engineers are studying the problem and it is very likely that a means of efficient operation will be found before long.

Another scheme which is appealing to the safety branch of the Bureau is the installation of a broadcasting set at each mine to advise the safety squads and first-aid man of an accident so that they could start for the scene immediately with their equipment. This is a simpler problem, the engineers state, and may be applied practically without delay, serving as a sort of fire-alarm system for a centrally located rescue crew.

Radio News

NAVY'S RADIO SHIP OFF FOR ALASKA

On July 11 the "Gold Star," the Navy's Radio Repair Ship, steamed out of Nanaimo en route to Kodiak, Alaska, where she will supply and repair the Navy's ten radio stations during the summer. This unique ship, captained by Comdr. John B. Earle, is named for the mothers of the men lost in the service during the World War. Equipped with all kinds of radio apparatus, spare parts and supplies, she carries a crew of expert repair and equipment men, capable of erecting a complete station or repairing a transmitting tube. The "Gold Star" is a 7,420-ton ship, carrying a complement of 300 officers and men.

Today the Navy is operating the following traffic stations in Alaska: St. George, St. Paul, Dutch Harbor, Kodiak, Seward, Cordova, Juneau and Ketchikan, and two compass stations at Cape Hinchinbrook and Soapstone Point, which form a chain of communications in Alaska and adjacent waters with trans-Pacific stations, besides serving as a relief in the event of a break in the Pacific cable. As the stations are all difficult to reach except between April and October, and few commercial vessels touch at the stations, the Navy has put the "Gold Star" into service to supply the men stationed there with food, clothing and relief. She will do all necessary repairing, which will require frequent trips from Seattle north nearly to the Arctic Circle.

ALL BUT TWO STATES NOW BROADCAST

The states of Kentucky and Mississippi went on the Department of Commerce's Broadcasting Map last week when stations in Louisville and Corinth were licensed. There are but two states, Delaware and Wyoming, left without broadcasting stations, every other state of the Union having one or more disepensers of news and entertainment via the ether.

Eleven limited commercial stations licensed last week bring the total broadcasters to 406. Of the new stations, Nevada, District of Columbia, California, New Jersey, Georgia, Illinois, Kansas, Montana and Wisconsin, besides Mississippi and Kentucky, opened one station each.

ELEVEN NEW LIMITED COMMERCIAL OR BROADCASTING STATIONS LICENSED DURING WEEK ENDING JULY 15

WHAO—F. A. Hill, Savannah, Ga.
WHAP—Dewey L. Otta, Decatur, Ill.
WHAN—Southwestern Radio Co., Wichita, Kans.
KFBB—F. A. Buttrey & Co., Havre, Mont.
WHAS—*Courier-Journal* and Louisville *Times*, Louisville, Ky.
WIAA—Waupaca Civic and Commerce Assn., Waupaca, Wis.
WHAQ—Semmes Motor Co., Washington, D. C.
KFBD—Clarence V. Welch, Hanford, Cal.
WHAR—Paramount Radio and Elec. Co., Atlantic City, N. J.
KFAS—Reno Motor Supply Co., Reno, Nev.
WHAU—Corinth Radio Supply Co., Corinth, Miss.

Note.—The call of the Galveston *Tribune*, assigned last week, is WIAC.

MARCONI SPEAKS

Speaking to unseen fans by the thousands from the General Electric's broadcasting station at Schenectady, Guglielmo Marconi, in a most embarrassed manner, made his first radio talk in America a few days ago.

He said: "I think that broadcasting has come to stay. In thousands of homes in this country there are radio telephone receivers and thousands of intelligent people, young and old, men and women, well able to use them, even able to make the apparatus, and in many cases contributing or striving to contribute valuable information concerning the problem still unsolved.

"I think I am safe in saying that since radio has already done so much for the safety of life at sea, for commerce and for commercial and military communications, it is also destined to bring new and unforeseen opportunities in health and recreation into the lives of millions of homes."

RADIO DEVELOPMENT IN SOUTH AFRICA

Various wireless telegraph schemes are now occupying the attention of the Government of the Union of South Africa. Trade Commissioner Stevenson has informed the Department of Commerce that the British Imperial Government has a scheme of connecting Great Britain and South Africa by a series of short range stations via Cairo and Nairobi, which will involve the expenditure on the part of the Union Government for its station of approximately £180,000. Under this scheme the range of the South African station is to be between 2,000 and 2,500 miles.

WIRELESS TELEPHONY

The possibility of utilizing wireless telephony in remote parts of South Africa and the parts otherwise difficult of access has been engaging the attention of the post office authorities. Two suitable Marconi sets were purchased in England and various trials and tests made in Swaziland and other remote parts of South Africa, as well as between Cape Town and Touws River in the Cape Province, a distance of 160 miles, by the local representative of the Marconi Company. While these trials proved very satisfactory so far as the range and efficiency of operation under favorable atmospheric conditions were concerned, the post office authorities express some doubt as to the commercial practicability of the method, particularly in a sparsely settled country like South Africa where the amount of traffic between the outlying districts would not be sufficient to guarantee the cost of the installation. A source of power is also necessary, and if, as would normally be the case in outlying districts, a gasoline engine and generator would supply the necessary power,

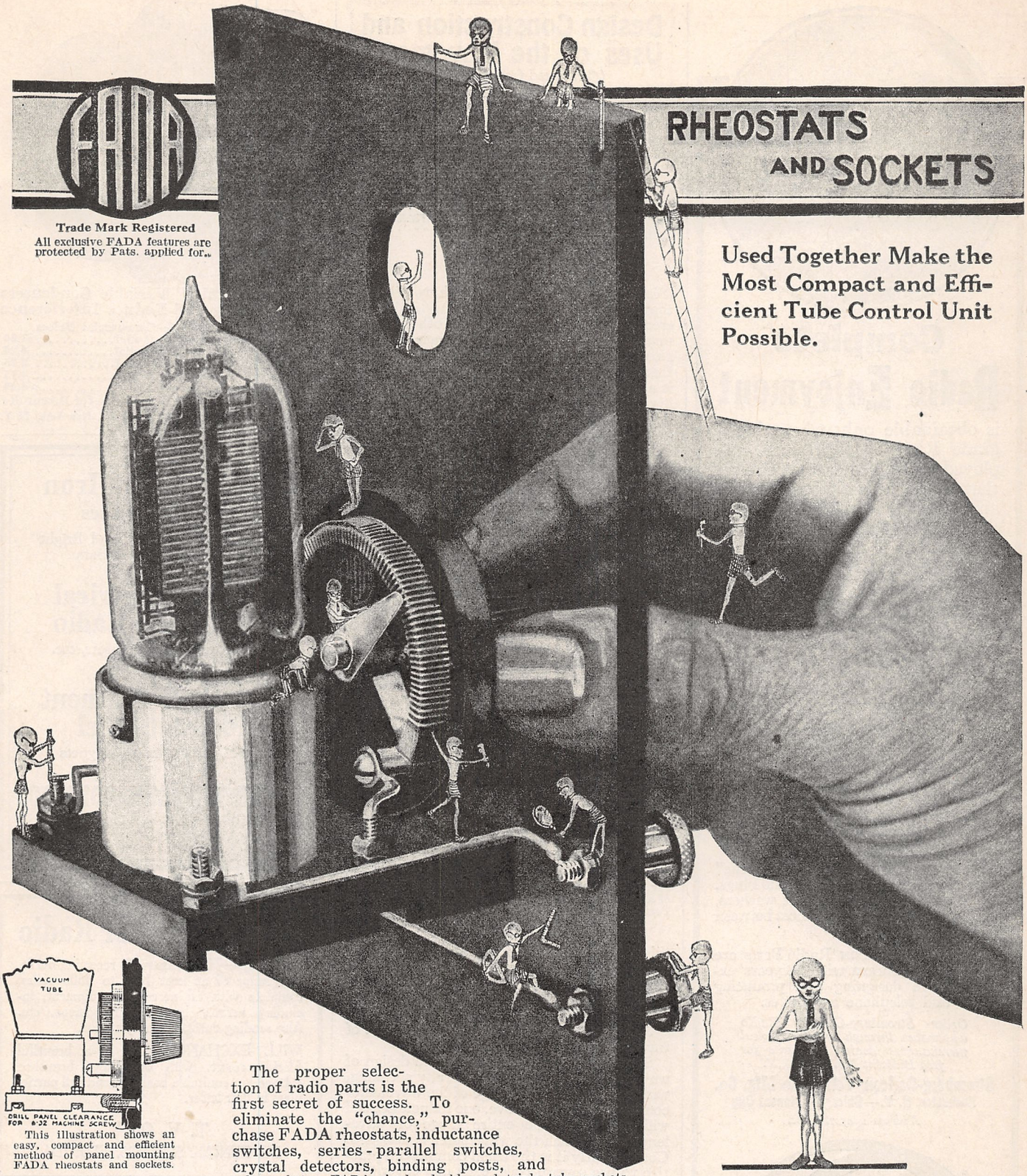
(*Continued on page* 570)

FADA

Trade Mark Registered
All exclusive FADA features are protected by Pats. applied for.

RHEOSTATS AND SOCKETS

Used Together Make the Most Compact and Efficient Tube Control Unit Possible.



This illustration shows an easy, compact and efficient method of panel mounting FADA rheostats and sockets.

Genuine FADA Rheostats
are being imitated in many ways

The best of imitations are never as good as the originals. Genuine FADA rheostats possess these features:

1. Heat resisting thermoplax base and knob.
2. Taper knob—fits the fingers.
3. Mounting screws do not show on front of panel.
4. Only genuine resistance wire used.
5. Properly designed contact brush that allows turn by turn adjustment and smooth movement.
6. Diameter over all is only 2⅛ inches.
7. Careful inspection—we reject rheostats that are really better than many of those now sold for "just as good."
8. Quantity production of a standardized rheostat means that every rheostat is uniform and dependable.

The proper selection of radio parts is the first secret of success. To eliminate the "chance," purchase FADA rheostats, inductance switches, series-parallel switches, crystal detectors, binding posts, and tube sockets. FADA single, double and triple tube sockets have these good features:

1. Genuine Condensite base affording the highest insulation resistance.
2. Deep trenches make contact springs immovable except as a tension against the tube contact pins.
3. Heavy phosphor bronze springs.
4. Socket base has metal inserts for panel mounting and nickel-plated screws are furnished.
5. Position of tube on base is offset to allow compact rheostat panel mounting, as shown in illustration below.
6. Screw holes for base mounting.
7. Terminals plainly marked.
8. Highly nickel-plated and polished brass tube with bayonet slot eliminating slot breakage as with moulded shellac or porcelain sockets.

Single Socket, $1.00. Double Socket, $2.00. Triple Socket, $3.00.

F. A. D. ANDREA
Manufacturer of FADA Radio Products
1581-a Jerome Avenue - - - New York City

We little fellows that typify the spirit of exactness and care with detail that makes FADA instrument work beautiful are without a name.

We have watched over the making and given our final okeh to hundreds of thousands of FADA rheostats, inductance switches, crystal detectors, binding posts and single, double and triple tube sockets.

We think that our work should be recognized, and we want a name that fits. Over in our safekeeping place we have a beautiful two-stage amplifier that we will give to the person to suggest the name that we consider best. In the event that two or more persons suggest the best name, we will give to each a two-stage amplifier identical with the one offered.

It is necessary to use FADA rheostats to adjust the filament current of your vacuum tube, whether you are using gas-content detector tubes, "hard" amplifier tubes or power tubes. The critical adjustment that can be obtained by using FADA rheostats will greatly increase the efficiency of your Radio set.

Complete Radio Enjoyment

is obtainable only where high-grade Radio apparatus is employed. In order to be sure that you haven't overlooked anything that will give you the most Radio enjoyment, comfort and efficiency, equip your receiving set with

Stromberg-Carlson Radio Parts

STROMBERG-CARLSON "Radio Head Set" fits comfortably, is quickly adjusted, has unexcelled tonal qualities and reproduces the faintest long-distance signals.

STROMBERG-CARLSON "Universal Radio Plug" should be attached to every Head Set—fits any standard jack—takes any type or size of conductor and takes wire loops, tinsel loops, pin tips or spade tips.

STROMBERG-CARLSON "Radio Jacks" are adapted to all standard Radio Plugs. They mount neatly without washers, on panels of varying thickness between ⅛" to ¼".

STROMBERG-CARLSON Radio Parts are made by a concern with 28 years' experience in designing and producing radio and telephone apparatus.

Order Stromberg-Carlson Radio apparatus through your electrical merchandise dealer, or write for free Bulletin No. 1029-R.N.

Stromberg-Carlson Telephone Mfg. Co.
Rochester, N. Y.—Chicago—Kansas City
Address nearest office.

Design Construction and Uses of the Wavemeter

(*Continued from page* 456)

This clearly defines the limits of the capacity employed in wavemeter design. We now consider the factors determining the limits of the inductance values employed. Here again the main consideration is sharpness of tuning. By considering the expression for the decrement of the wavemeter, namely,

$$\delta = \pi R \sqrt{\frac{C}{L}}$$

it is seen that if we make L high we decrease the decrement and thereby considerably increase the sharpness of tuning, other factors remaining equal, but when we increase L we also increase R, the coil resistance, and thereby increase the decrement. Thus there is a maximum value of L beyond which it is disadvantageous to go. Likewise L cannot be reduced too much, for although R would be decreased correspondingly, there would still be a rise in decrement due to decreased inductance. Thus there must be the usual engineering compromise and this is effected by employing the above limiting range of capacity values and designing the inductance in a way to give the minimum resistance.

Summarizing thus far the design considerations we have the following necessary requirements:

1. High capacity of main condenser and low capacity or what amounts to the same thing, high reactance for the resonance indicator, for a minimum effect on the wavelength.
2. High inductance to increase sharpness of tuning.
3. Low resistance to decrease decrement of wavemeter.

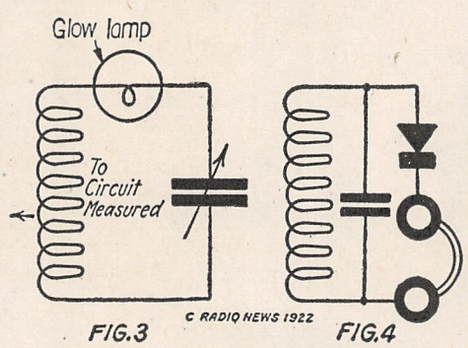
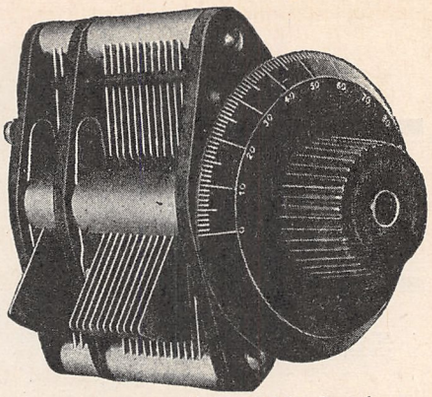


Fig. 3, Shows How Resonance is Indicated by Means of a Lamp When the Wavemeter is Used to Tune a Transmitter. In Fig. 4, the Method of Finding Resonance With the Phones is Illustrated.

Some other considerations in the design of wavemeters are these. Generally speaking, with a given capacity range of the wavemeter condenser as given above, one inductance coil will not cover the entire range of wavelengths for which the wavemeter is designed. Consequently it is the usual commercial practice to use several coils, each coil covering a given range which is a portion of the total wavemeter range. These ranges of the various coils always overlap by a certain amount. Thus suppose the wavemeter is designed to cover a range of wave-lengths from 100 to 4,000 meters. Coil 1 having the lowest inductance will cover approximately the range from 100 to 350 meters; coil 2, from 250 meters to 750 meters; coil 3, from 500 to 2,000; coil 4, from 1,500 to 4,000. It is seen how the first part of any particular range covers the last part of the next preceding range, thus providing the necessary overlap. It will be obvious that the less the overlap the fewer coils will be required to cover the entire wavemeter range. Finally, in wiring, care should be taken to make the leads as short as possible, and wherever possible in calculations their capacity effect should be taken into account.



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23 plate VERNIER, without dial	6.25
3 plate VERNIER, without dial	2.25
43 plate Regular, without dial	4.75
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WANTED—High class radio receiving outfit, with range of at least 1000 to 1500 miles, complete with all necessary equipment, including aerials, batteries, Magnavox, etc. Also sending outfit, ordinary radius.

WILL EXCHANGE—Lot in a beautiful Florida resort, with or without furnished cottage, on equitable basis. Send full particulars in first letter.

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Super-Sensitive—Remarkably Sharp and Clear Signals
Can Be Used With Indoor Coil or Loop Aerial

MU-RAD TYPE MA-13 RECEIVER

Specifications for the MU-RAD MA-13 Receiver

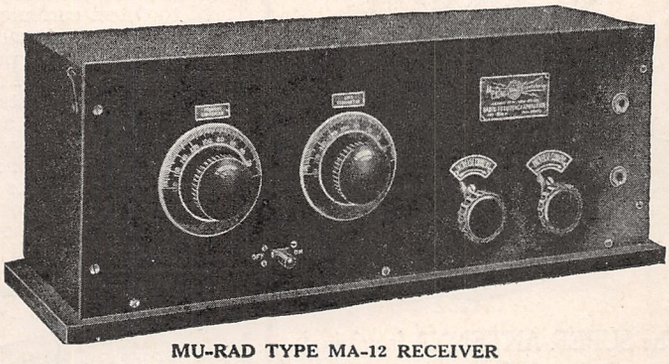
Cabinet: Solid mahogany, varnished piano finish.
Panel: Mirror polished black Radion.
Dials: Non-warping metal—prevents body capacity effects.
Condenser: 21 plate, permanent capacity.
Modifier: A circuit unit, dial operated from panel, for controlling signal strength and stabilizing circuits.
Rheostats: Special sector wound, smooth operation, positive contact.
Filament Switch: Special positive toggle knife-blade construction.
Binding Posts: Polished nickel, all in rear plainly marked.
Name Plates: Extra deep reverse etched, black with satin silver high lights.
Wiring: Tinned copper bus-wire, all interior metal white nickel finish.
Circuits: Three stages radio frequency amplification, detector and two stages audio frequency amplification.

PRICE with 2 Telephone Plugs **$160**

Specifications for the MU-RAD MA-12 Receiver

Cabinet: Solid mahogany, varnished piano finish.
Panel: Mirror polished black Radion.
Dials: Non-warping metal—prevents body capacity effects.
Condenser: 21 plate, permanent capacity.
Modifier: A circuit unit, dial operated from panel, for controlling signal strength and stabilizing circuits.
Rheostats: Special sector wound, smooth operation, positive contact.
Filament Switch: Special positive toggle knife-blade construction.
Binding Posts: Polished nickel, all in rear plainly marked.
Name Plates: Extra deep reverse etched, black with satin silver high lights.
Wiring: Tinned copper bus-wire, all interior metal white nickel finish.
Circuits: Three stages radio frequency amplification and detector.

PRICE with 2 Telephone Plugs **$128**



MU-RAD TYPE MA-12 RECEIVER

They Mark the Advance of More Dependable Radio Goods

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Craftsmanlike in Appearance, Durability and Performance!

In appearance these sets exemplify the art of the finest woodworkers, machinists and laboratorians. Their details of design and construction conform to the highest engineering standards. Complete instruction book is furnished with each set and each is tagged with our guarantee against defects. Bulletin No. 13 on request.

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The radio public this fall will insist on quality. It will be a seller's—not a buyer's—market. These MU-RAD Receiving Sets are the type of well-made, quality material, superiorly designed, better value radio merchandise which will sell faster and earn the radio business man a larger profit than inferior stuff turned out to meet an abnormal demand. Write for our proposition and Bulletin No. 13.

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The
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It is fool-proof and shock-proof and can be used effectually in place of overhead Antenna.

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It operates on any electrical circuit from 32 to 120 volts D. C. or A. C.

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"Why Use An Antenna?"

RESONANCE INDICATORS AND METHODS OF CONNECTING TO WAVEMETER

There are a large number of resonance indicators which may be used with wavemeters, such as thermo-coupler attached to millivoltmeter, detector and galvanometer arrangement, etc., but for practical wavemeter work there are just a few which are of interest to the amateur, the others being used for special measuring purposes. We will here confine ourselves to these few.

The first and simplest type of indicator which the amateur can always use, especially with makeshift wavemeters, is the glow lamp. A small two-volt lamp connected in series with the wavemeter circuit, as shown in Fig. 3, will give fairly good results, depending upon the keenness of the observer's eyesight. Coupling the wavemeter to the source to be measured will result in lighting this glow lamp. As the wavemeter condenser is varied and resonance is approached the glow lamp becomes more and more brilliant, and after the resonant condition is passed it fades again. Resonance is obtained when the glow lamp lights up most brilliantly.

For more accurate results a hot wire milliammeter should be used, or a current squared milliammeter. The resonance point is more accurately secured with these meters and furthermore they have the advantage that quantitative measurements may be made with their aid. A good range of meter is a 0-100 milliammeter.

Neither of the above types of resonance indicators is good for work on receiving sets. They respond to relatively large currents only and a much more sensitive indicator must be used to detect currents of the magnitude of received currents usually found in receiving antennae. For this purpose the best and most sensitive type of resonance indicator is the usual crystal detector and head telephones. With such an arrangement resonance is indicated by the maximum signal heard in the telephones. The question of connecting the detector and telephones to the wavemeter is an important one. There are two main methods, shown by Figs. 4 and 5, the latter being called the unipolar method

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Globe Radio Head Phones

Highly sensitive, balanced receivers, natural in tone and light weight (only 11 oz.). Each set tested wirelessly.

Globe Phones will stand amplification without distortion, and the articulation is perfect.

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For use in apartment houses, homes, etc. Use the electric light wire for your antenna. The Globe Antenna Attachment Plug allows you to connect your Radio receiving set in any room. No other wires necessary. Ask for the Globe Plug. Particulars on request.

We are also the sole distributors of the Globe Vactuphone, invention of Earl C. Hanson, the only hearing device made for the deaf using the vacuum tube amplifier.

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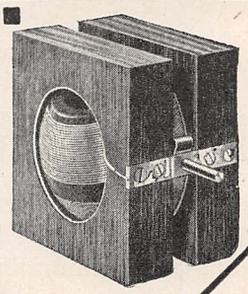

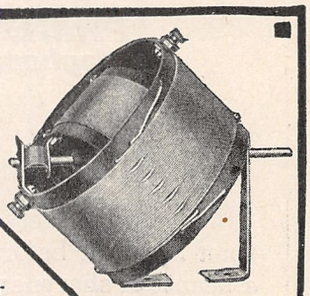

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NATIONAL Variocoupler $4.50

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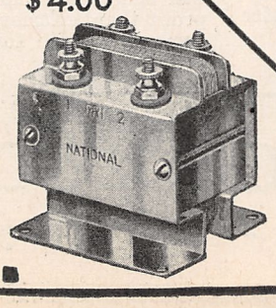

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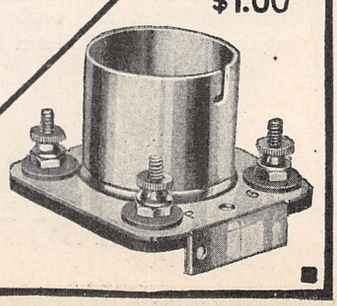

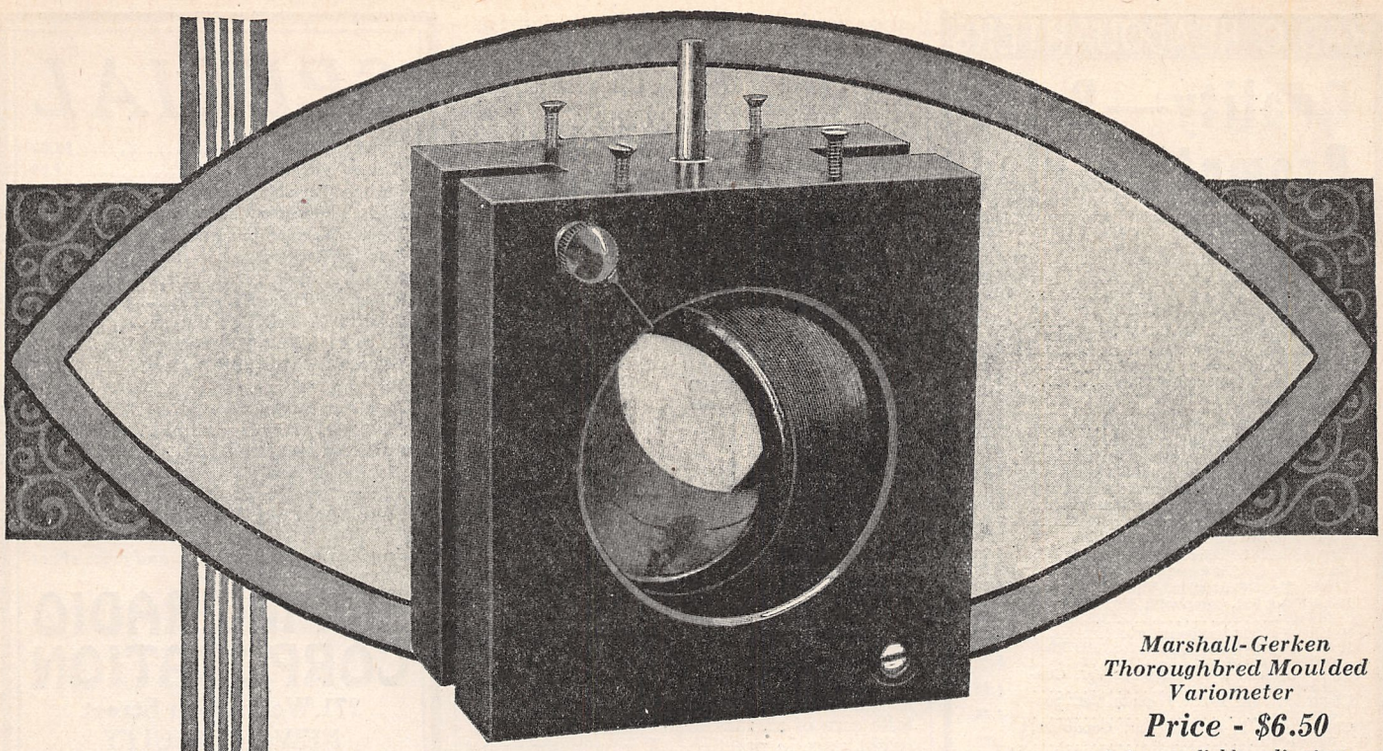

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Thoroughbred Moulded
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Price - $6.50
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A definite way to secure fine wave length adjustment

CONTINUOUS wave transmitters are so sharply tuned that even a fraction of a turn of inductance makes an appreciable difference in the returns secured. It is therefore impossible to tune your receiving set with any real degree of accuracy so as to throw out undesirable stations and concentrate on the desired broadcasting station unless you employ a variometer. By turning the knob of a Marshall-Gerken Thoroughbred Variometer a range of wave length values varying from two hundred to six hundred meters may be obtained as desired. You are certain of securing an exceptionally fine adjustment.

Connections are made in the rotating element through brush contact so that the ball may be continuously rotated without breaking connections. There are no loose contacts to bother with and the rotary action is far more convenient than the movement of sliders along a tuning coil. Marshall-Gerken Thoroughbred Variometers are made in two styles, one for the Plate and one for the Grid. This is a valuable feature found only in these products. Their correct weight makes screws unnecessary for table operation and they are supplied with four screws for panel mounting. You can buy them from your nearest radio store for $6.50 apiece.

Other Marshall-Gerken Products produced in our large new factory are Vario-Couplers, "Read-'em" Binding Posts in 17 styles, Two-step Amplifiers, Non-regenerative Sets, Amplifier Panels, Detector Panels.

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(Tubes, batteries and 'phones are extra, except as noted.)	
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Cutler-Hammer H-1 Vernier Rheostat	1.50
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Murdock No. 56 Phones 2000 ohms	5.00
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Brandes Superior Phones	8.00
Brandes Superior with Universal Plug	9.75
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Federal 53W Phones 2200 ohms	8.00
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Magnavox R-3, 14-inch Horn	45.00
Jewell No. 53 Combination Filament Ammeter	10.00
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Acme A-2 Amplifying Transformer, mounted	7.00
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R. C. UV-712 Amplifying Transformer	7.00
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Keystone Radio Lightning Arrester	2.00
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IN BUSINESS SINCE 1860

JULIUS ANDRAE & SONS CO.
117 MICHIGAN ST. MILWAUKEE, WIS.

of connection. The unipolar method of Fig. 5 has one great advantage over the more usual one of Fig. 4, and that is that the calibration of the wavemeter is hardly affected by the unipolar connection, whereas the other method does affect it as explained above. The unipolar method requires closer coupling than the other, which is quite a disadvantage. However, if in calibrating the wavemeter, account is taken of connecting the detector as in Fig. 4, it will be best to use that type of connection.

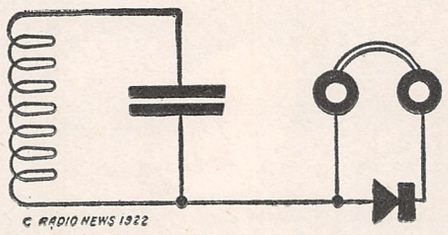

FIG. 5

In This Circuit Unilateral Conductivity is Used. Sharper Resonance is Obtainable by This Method.

USE OF A BUZZER IN A WAVEMETER

A wavemeter is not built every other day, and therefore if the amateur does build one he should so build it that it will be able to take care of all measurements and uses that might arise in practice. A wavemeter without a buzzer means only half the work done. The wavemeter without a buzzer may take care of all possible measurements, uses and adjustments on the transmitter, but with a buzzer it will handle the receiver and other calibrations and measurements, for the buzzer on a wavemeter converts the wavemeter from a receiver of oscillations to a combined generator and receiver of oscillations. The buzzer may be used to excite the wavemeter circuit and thus produce oscillations which can be used to calibrate receivers, other wavemeters, and radio frequency circuits. Its connection is shown diagrammatically in Fig. 6, and the wavemeter should be designed either containing the buzzer, or with two binding posts properly connected, to which it is only necessary to connect an external buzzer.

USES OF THE WAVEMETER

We will now take up in detail the various uses to which the wavemeter may be put, explaining the theory and actual practice.

(a). *To Measure the Wave-length of an Oscillating Circuit.* It is first necessary to excite or set up oscillations in the circuit to be measured. If the circuit is a transmitter circuit

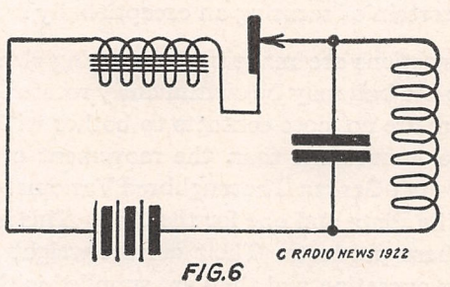

FIG. 6

Showing How the Calibrated Circuit is Excited by Means of a Buzzer When the Wavemeter is Used as a Driver.

the oscillations may already exist in it. If it is a simple R. F. circuit it may be necessary to excite it by means of a buzzer connected, as shown in Fig. 6. The wavemeter is coupled to the oscillating circuit, and the V. C. altered until either the ammeter in wavemeter reads a maximum or the signals in the phones is at maximum intensity. This will then be the resonant condition and the wavemeter reads the wave-length. The best practical procedure is to couple the wavemeter closely at first and get an approximate resonant setting. Then loosen the coupling and obtain the final accurate setting.

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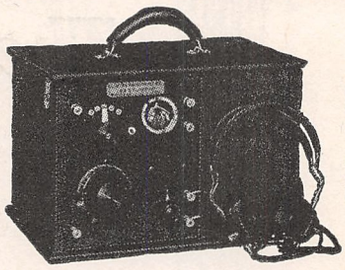

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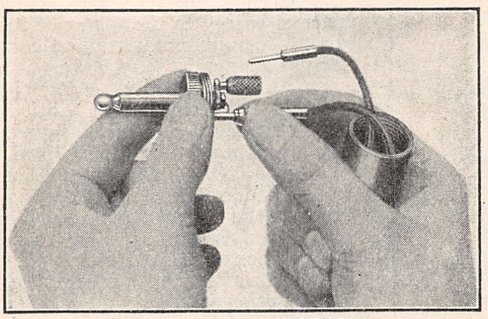

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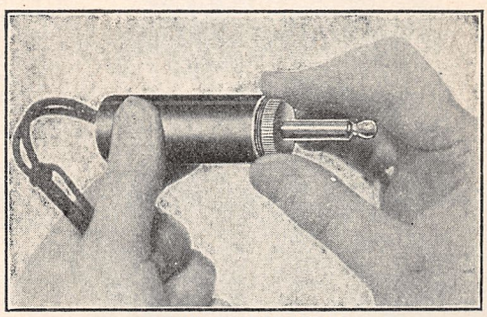

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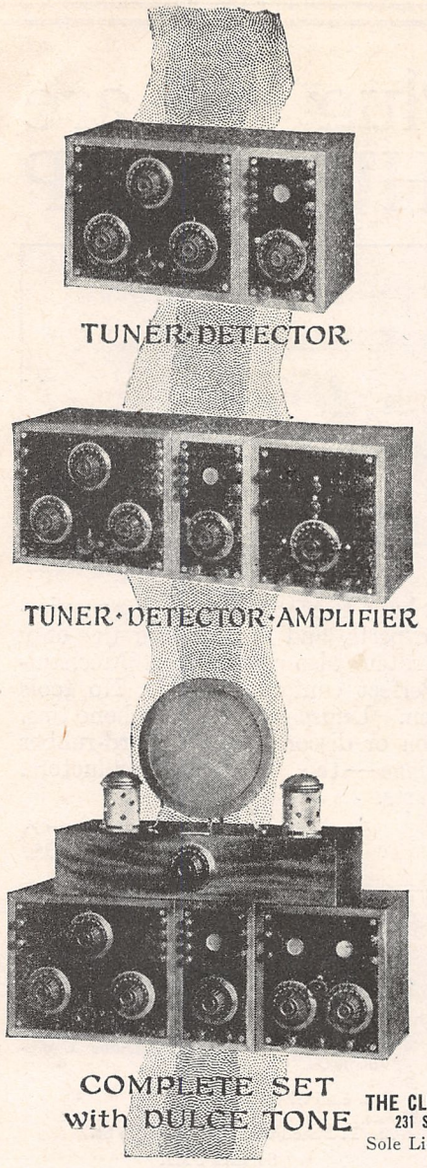

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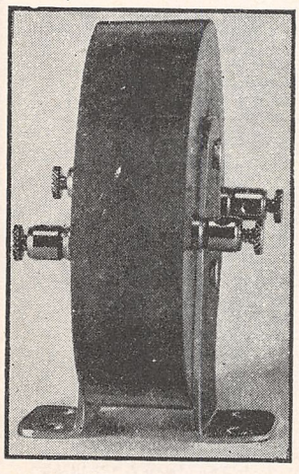

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(b) *To Tune a Transmitting Set.* This is an important operation, not only in commercial work but also for amateurs. Many amateurs who think they are radiating at 200 meters would be very much surprised to learn how far they were from 200 meters. In this case the ammeter should be used as resonance indicator. Couple the wavemeter coil to the antenna as in Fig. 8 and start the transmitter. This time keep the coil very loosely coupled to the antenna, for if closely coupled the transfer of energy to the wavemeter may be so great as to burn out the small milliammeter. Gradually tighten the coupling until the wavemeter ammeter gives a fair sized deflection. Now vary the V. C. until the setting for maximum deflection is found. This setting gives the wave length radiated. Suppose it reads 240 meters and 200 meters is desired. Reduce the amount of loading inductance in the antenna, and make the necessary adjustments to bring the transmitter into proper relation with the antenna and maximum output is obtained. Repeat the wavemeter operations and note the reading of the wave-length. If it is still above 200 repeat the performance; if it is below 200, add some loading and remeasure, until the wavemeter reads 200 meters at resonance. In the event that there are two oscillating circuits, as in gap sets, this should be repeated not only for the open circuit, but also for the closed gap circuit, as it is very important that both open and closed circuits be tuned to the same wave for maximum results.

(c) *To Determine the Characteristics of a Coupled Circuit.*—When two circuits which are tuned to the same wave-lengths are coupled together it is known that the interaction between them results in altering the radiated wave; that is, coupling wave-lengths are produced which differ from the tuned wave-length of each circuit by a definite prescribed amount, depending upon the degree of coupling. In transmitter sets employing coupled circuits it is important to know what the characteristics of the radiated wave are, and by how much the radiated coupling waves differ from the tuned waves of the closed and open circuits. A resonance curve, plotted by means of the wavemeter, gives the information accurately. This curve will also give reliable and important information as to the quality of the quenching if a quenched gap set is employed. This curve can be readily obtained in the following simple manner. Tune each circuit to the desired wave by means of the wavemeter by method (b), then couple the circuits and adjust the transmitter for maximum radiation and efficiency. Now with the milliammeter in the wavemeter circuit couple the wavemeter to the antenna and take a series of observations of both wave-lengths and corresponding ammeter deflections. Plot the wave-lengths against ammeter deflections and a "resonance curve" will be obtained. The accompanying graph or resonance curve is an actual one taken on a rotary spark set circuit using the following apparatus: A 60-cycle motor generator set supplied power to a 1-K. W. Thordarson magnetic leakage transformer through a reactance. Secondary capacity was 0.001 mf., and the spark gap was a Murdock Non-synchronous Rotary. The oscillation transformer was made up of two cylindrical co-axial helices of copper tubing. Two edgewise wound loading coils were employed. The set was tuned for 600 meters with fairly loose coupling and the curve obtained is that shown in the attached graph. It is seen from the resonance curve that there are two coupling waves produced (two peaks represent these waves), and they are 510 meters and 650 meters. They are far removed from the fundamental wave of the transmitter and consequently the coupling is too close. As a result considerable QRM is created by such a radiated wave, and amateurs would do well to carefully study their radiated wave.

(d) *To Determine Degree of Coupling.*—Having plotted such a resonance curve, some further data about the transmitter can be secured. One is the determination of the per-

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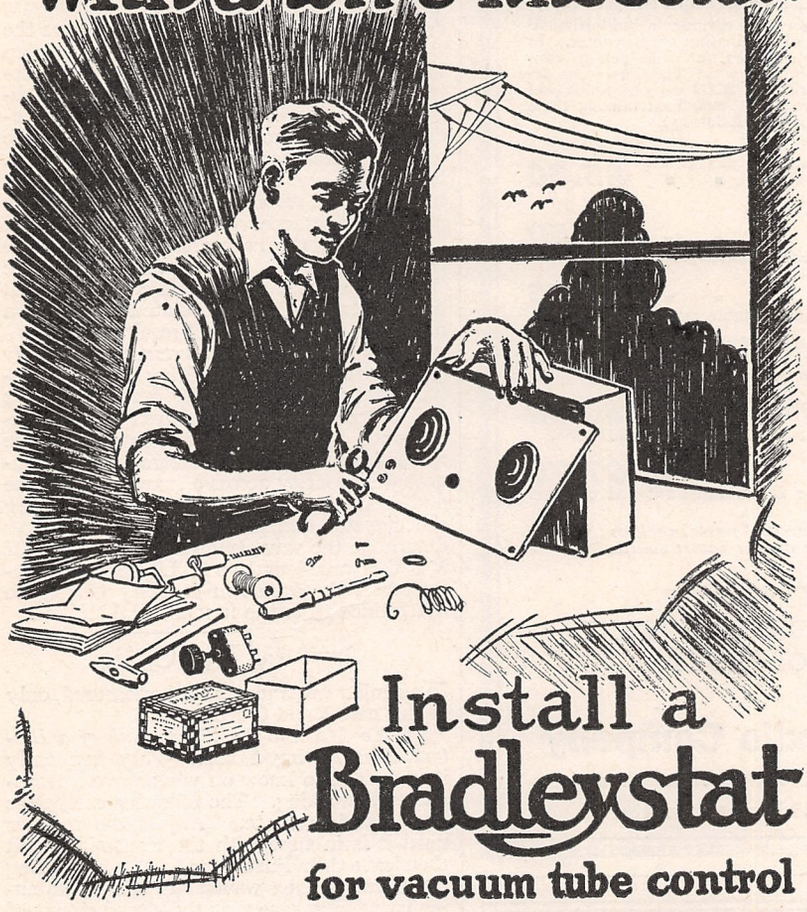

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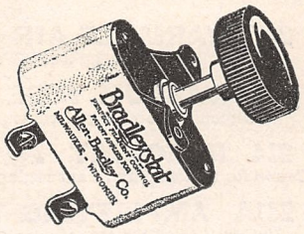

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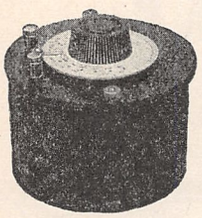

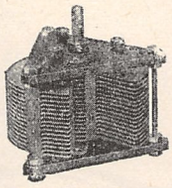

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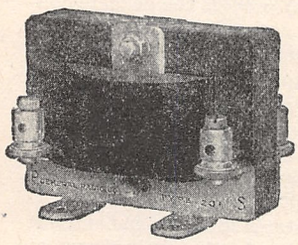

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centage coupling of the oscillation transformer. Let λ_0 be the wave-length to which both circuits are tuned, in this case 600 meters; let λ_1 be the shorter coupling wave, in this case 500 meters, and let λ_2 be the longer coupling wave, in this case 700 meters. It can be shown theoretically that the percentage coupling is given by the formula

$$K = \frac{\lambda_2 - \lambda_1}{\lambda_0}$$

Substituting our values in this case we find that the coupling is

$$K = \frac{700 - 500}{600} = 33\%$$

(e) Knowing from the resonance curve the coefficient of coupling we can go one step further and obtain more data. We can determine the mutual inductance of the oscillation transformer if we know the self inductances of primary and secondary. The mutual inductance is given by the formula. Knowing L and L π and K from the previous measurement, we can easily calculate M, the mutual inductance. The smaller K is, and therefore M, the nearer together will these two coupling waves be, and the purer will be the radiated wave. If K is zero there will be only one peak, one radiated wave and a minimum interference will result.

(f) *To Measure the Inductance or Capacity of Coil or Condenser.*—In either of these measurements a known quantity is required, that is if capacity is being measured a known inductance is required and *vice versa.* The method is simple. To measure capacity connect the capacity across a known inductance and excite the circuit with a buzzer. Using the detector and phones on the wavemeter determine the wave-length of oscillation. If λ is the wave-length, and L the known inductance, the unknown capacity C may be determined from the fundamental relation

$$\lambda = 59.6 \sqrt{L_{cms}\, C_{mfds.}}$$

In a similar way inductance is measured, only in this case λ and C are known.

(g) *To Measure the Wave-length of a Distant Transmitting Station.*—Very frequently it is desired to know on what wave a transmitter is working. The following method is simple and accurate. Adjust the receiver until it is in tune with the transmitter and then leave the adjustments fixed. Now using the buzzer driven wavemeter excite the antenna, making sure that the closed circuit of the receiver is not excited at the same time. Vary the condenser on the wavemeter until maximum signal is heard in the receiver phones, the wave-length thus indicated by the wavemeter is the value of the transmitted wave from the distant station.

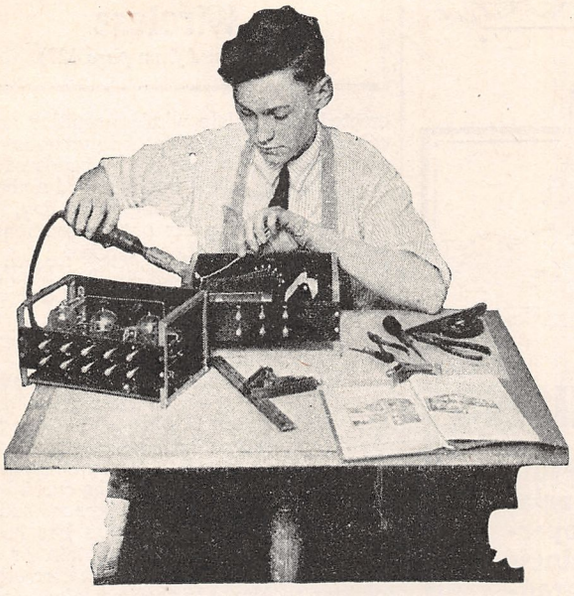
(h) *To Calibrate a Receiver.*—This can very simply be accomplished by using as above the buzzer driven wavemeter. Set the wavemeter at different wave-lengths and tune the receiver to each wave. Note the resonance point by listening in on the receiver. Then plot a curve showing indicated wave-length against receiver condenser degrees. Or the wave-length may be indicated on the receiver dial directly.

It is hoped that the design factors given at the beginning of this paper will be of material assistance in aiding amateurs to design their own wavemeters, and the methods of measurement here outlined will show the variety of information and data which a wavemeter enables the amateur to obtain. This is, as stated above, the most important instrument for measurement purposes which every amateur ought to have, and if this article supplies to amateurs the impetus for the building of his own wavemeter, the writer will feel that this article was worth while.

DO YOU THINK SHE WOULD LAUGH?

If you can't get any entertainment out of your single-circuit tuner use the "tickler" more vigorously.

By A. J. De Long.



This Experimenter's Set Will

WORK

Because he is building his instruments in accordance with the instructions given in

MODERN RADIO RECEIVING SETS

By M. B. SLEEPER

MODERN RADIO RECEIVING SETS, the "Brown Book" and the "Blue Book," are the kind of books that you need, not to keep in the bookcase but to work with every day in your shop. The clear photos, scale drawings, and explicit instructions cover apparatus so simply designed that you can build it in a kitchen table work shop with ordinary tools and standard parts, yet the instruments are so well designed that in appearance and operation they are equal to commercial equipment. And remember that these fifty-cent books cover a dozen different instruments, giving more details than blue prints which sell for a dollar and describe only one device.

"THE BROWN BOOK"

Modern Radio Receiving Sets

50c ***Postage 4c***

LIST OF CHAPTERS

Short Wave and Long Wave Loose Couplers
150-3,200 m. Single Circuit Audion Set
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Detector and 2-Step Amplifier
Simple Crystal Set for Broadcast
Radio Frequency Amplifier
12,000 to 20,000 m. Receiver
150-600 m. Regenerative Set
Some Common Radio Problems
Ideas for the Shop and Laboratory

IMMEDIATE DELIVERY

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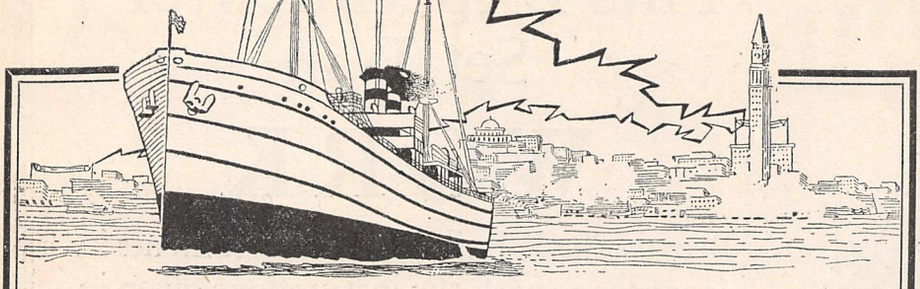
SLEEPER RADIO CORPORATION

88-N Park Place Successors to THE GENERAL APPARATUS CO., Inc. **New York City**

STUDY WIRELESS



Positions Guaranteed Our Graduates

Our class room equipment includes among other things a

1 KW NAVY STANDARD SHIPPING BOARD SET

and 5 latest type complete commercial transmitters—*the largest and best equipment of any Radio school in the New England States.*

AS the acknowledged leading Radio school of New England, our relations with steamship lines, operating companies and radio business institutions enable us to place our graduates in good paying positions at once.

In fact, besides establishing a record for number of graduates qualifying for First Class license, we have placed more graduates in the last 2 years than any other New England school.

Ours is the oldest Radio school in New England, having been established as the Boston School of Telegraphy in 1903.

Fall Classes Start September 11th. Apply NOW!

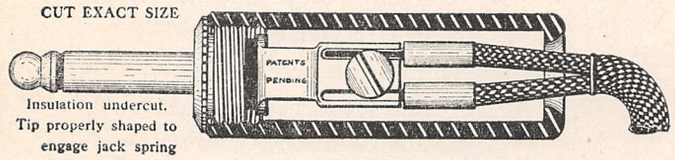
MASS. RADIO and TELEGRAPH SCHOOL
18 BOYLSTON ST., COR. WASHINGTON ST., BOSTON

Send for FREE Catalogue

Carter TU-WAY Radio Plug

Special designed terminal permits two phone sets to be connected at the same time. Positive contact made with any type of cord terminal or wire.

CUT EXACT SIZE



Insulation undercut. Tip properly shaped to engage jack spring

Black finish, non-breakable, round, one piece handle not affected by body capacity; no screws used to hold handle in place.

PRICE **$1.50**

This Plug was inadvertently described in the July issue as the Waco Plug

Wireless Appliances Co.
OLD COLONY BLDG. CHICAGO

IF YOU CAN'T READ

Dots and dashes you are missing the most important and interesting part of radio receiving. Continental Code Chart as used by author in teaching, is the surest, quickest and most reliable way of learning. $1.00, no stamps.

E. A. NIELSEN **Box 67, Waverley, 79, Mass.**

Prescriptions by Wireless

(*Continued from page* 427)

erected a complete wireless sending and receiving station, capable of intercepting messages from a distance of thousands of miles. A continuous watch was installed and operators remained on duty night and day, listening for some ship far out at sea requiring either medical or surgical advice.

The call letters of the station, KDKF, were assigned by the United States Government and the station immediately had special privileges, being given the right of way over all amateur stations.

It was not long before mariners and masters of vessels learned about the services offered free of charge by KDKF and many began to utilize the apparatus for securing assistance when some one on board was afflicted with some malady that could not be cured by the crew. Many times the person suffering from some unknown affliction has been in great danger because the captain or other members of the ship could not correctly administer to him. It then remained for the wireless operator to get in communication with the Seamen's Church Institute in New York City and explain the symptoms to the operator in charge who, in turn, explained the sickness to the doctor in charge at the Institute and immediately a prescription was forwarded.

A few examples of the rapid and important service rendered by the wireless station are herewith given:

On January 16, 1922, the following message was received from the steamship *Princeton:*

"11.55 A. M.—Request medical advice for man suffering from severe pains across small of back, and finds difficulty in breathing.

(Signed) "CAPTAIN HOUSTON."

Immediate telephonic communication was established between KDKF and the Hudson Street Hospital, U. S. Public Health Service, and the following treatment prescribed:

"12.03 P. M.—Use externally Epsom salts, pint to five drops carbolic acid. Apply hot applications of antiphlogistin for hours until pain has been relieved. Apply hypodermically either morphine, one-quarter grain, or atropine sulphate, one one-hundred and fiftieth grain. Give internally ten drops of aromatic spirits of ammonia.

(Signed) "DR. GREAZES."

This message was received on the *Princeton* a few minutes after the information was requested and the treatment applied to the ailing man, who recovered.

Below is listed a memorandum of some known cases where assistance was rendered through Radio Service for sick and injured men at sea and in the Port of New York.

December 21—*Menepier* (Belgian)—Broken legs and arms treated by doctor on *Winifredian.*

December 1—*Hegira*—Chief engineer sick, transferred to *Princess Matoika*; sent to hospital in Germany.

November 21—*Munaires*—Treatment prescribed by Hudson Street Hospital.

November 19—*Canadian Volunteer*—Treatment prescribed by Public Service Hospital.

November 9—*Haliartus*—Treatment prescribed by doctor of S.S. *Vestria.*

October 20—*Occidental*—Second assistant engineer set to Marine Hospital.

October 20—*Norfolk*—Blood poisoning. Treatment prescribed by Public Health Service Hospital.

September 22—*Wekira*—Ptomaine poisoning. Treatment prescribed by doctor of S.S. *America.*

August 20—*Eldina* (per *City of Omaha*)—Treatment prescribed by Public Service Hospital.

August 20—*Archer*—Injured seaman to hospital.

August 20—*Varg* (Norwegian)—Second officer sick. Doctor to ship.

A Wonderful Achievement!

PATENTED
Sept. 4, 1917; Oct. 12, 1920; Pat. Pend.
Jan. 21, 1908; Sept. 7, 1909; Nov. 24, 1914
Nov. 17, 1908; July 21, 1914; April 27, 1915
June 15, 1909; Sept. 8, 1914; Jan. 23, 1917

RADIO BLINKER

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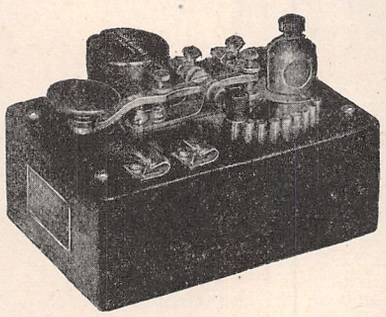
So Simple a Child May Operate It!

RECEIVING SET

The smallest practical receiving set manufactured



Size, $5\frac{5}{16}$" x $3\frac{11}{16}$" x $3\frac{1}{2}$"—Net Weight, 1 lb.

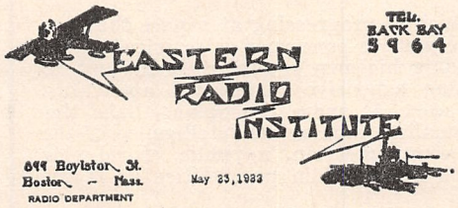
THE THREE IN ONE SET

(1) A practical, efficient, self-contained Wireless Receiving Set for Radio Phone Broadcasting and Commercial Stations approximately 150 to 800 meters wave length.
A newly designed dustproof crystal detector, extremely sensitive. Can be quickly adjusted by means of buzzer test and locked in position.

(2) A miniature Sending Set within limits of buzzer radiation.

(3) A Practice Set for code work.
Ready for phones, aerial and ground connections.
Sold on merit with our usual guarantee.

Real Results With the Radio Blinker Receiving Set!



TEL. BACK BAY 5964

648 Boylston St.
Boston — Mass.
RADIO DEPARTMENT

May 23,1922

Frank B. Perry & Sons,
513 Hospital Trust Bldg.,
Providence, R. I.

Gentlemen;

After giving your Radio Blinker Receiving Set a very rigid test here at the Institute we take pleasure in writing you concerning the results that we obtained during this test.

The outstanding feature of your receiving set is the simplified adjustment of the crystal detector which we found very sensitive on all signals.

Moreover the purchaser of this crystal receiver is obtaining a combined receiving and buzzer practice set which is excellent for one to learn the code on.

Wishing you success with your little set, we are,

Very truly yours,

EASTERN RADIO INSTITUTE

A. D. Moulton

adm/s

Superintendent

Equipment No. 1

1 Radio Blinker Receiving Set
1 Pair Western Electric Co. Head Phones of best quality.

Equipment No. 2

1 Radio Blinker Receiving Set
2 Pair Murdock 3000 ohm Head Phones.
150′ Antenna Wire.

Price, for either equipment as above, $25.00. Ask your nearest dealer and if he cannot supply you write us for further information.

Manufactured Solely by

Frank B. Perry & Sons

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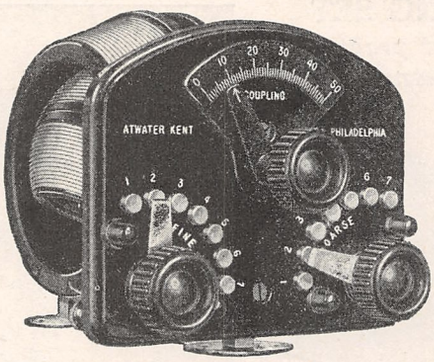
ATWATER KENT
RADIO APPARATUS



Variocoupler with Panel

Atwater Kent Radio Apparatus has been received with enthusiastic approval. A maintenance of the same standards of quality, accuracy and precision inherent to all Atwater Kent products assures maximum performance.

Exhaustive laboratory tests at home and abroad attest to its efficiency.

Variometers, Variocouplers, Audio Frequency Amplifying Transformers, Table and Panel Mounting Rheostats, etc., are made complete in this Plant.

New units are being produced from time to time. Before purchasing send for latest literature.

ATWATER KENT MANUFACTURING COMPANY
4943 STENTON AVE., Radio Dept., PHILADELPHIA, PA.

RADIO MEN WANTED

THE world's new industry is radio, which is progressing at a pace that has outstripped all records. Today everyone is concerned with wireless development, from the youngest boy, building his own crystal receiving set, to the largest electrical corporation, making expensive commercial apparatus. Radio is the world's safeguard of the seas. It spans the oceans, links the continents together, and brings to the smallest hamlet the intelligence of the world. Radio is the latest means of communication, a public, world-wide utility, romantic in its operation and as unlimited in possibilities as is the mind of man.

Get in this new industry today, while it is still in the growing period, while the greatest opportunities are offered to men of intelligence and initiative. Today there are not enough trained men to go around. Men, men, and more men, is the cry. The radio industry today needs YOU.

The one best way in which to touch this industry at its very center is through the course of study of the Radio Institute of America, a course that has been developed steadily with the industry during the past fifteen years, and has turned out over 6,000 trained men, 95 per cent. of whom have engaged successfully in this new branch of science and industry.

The graduates of the Radio Institute of America enjoy an exclusive advantage because of the close relation existing between it and the Radio Corporation of America, the world's largest wireless organization, operator of the Long Island Station, that is heard round the world.

Among the thousands of Radio Corporation employes, on ships and ashore, in offices, factories and laboratories, are many former students of the Radio Institute. Think what an advantage it gives you to be able to say: "I am a graduate of the Radio Institute of America."

Thousands of operators and executives all over the country, both in and out of the Radio Corporation, know what that phrase means. They know that it means that the man who says it, is trained in every phase of wireless—spark, arc, continuous wave, interrupted continuous wave transmitters, the design, maintenance and repair of transmitting and receiving equipment, storage batteries, motor generators, code sending and receiving, operation of the radio telephone, radio goniometry (direction finding), radio laws and regulations.

Everything necessary for making you a successful man in this new and tremendously important radio industry is taught you by the Home Study Course of the Radio Institute of America.

Radio, the newest development of the electrical industry, offers bigger things than the world has yet seen to those who will begin now to help work those things out to success. Will you be one of those who will forge ahead with this new industry?

The Radio Institute of America offers two courses of instruction, one in classrooms and laboratories, to those who can attend personally in New York, and the other by mail. The mail course is skillfully worked out and exactly parallels the personal course. Each student of the Home Study Division has personal attention given to his progress by the experts of the Institute; he loses nothing by not being in New York, and gains by living at home. Code instruction at home is rendered possible by an ingenious automatic transmitting device, variable in speed, so that the beginner learns the code as fast as he is able, exactly as if an instructor sat at his side.

There is a booklet which we send free to you—"Radio, the New Field of Unlimited Opportunity." Send for it and learn more about the extraordinary things that Radio offers to all men of energy and ambition. Send for it today.

HOME STUDY DIVISION

Radio Institute *of* America
(Formerly Marconi Institute)
324 Broadway, New York

July 6—*City of Omaha*—Man gassed. Treatment prescribed by Public Service Hospital.

July 9—*Vesta*—Blood poisoning. Public Service Hospital.

June 23—*Orbita*—Appendicitis. Transferred at sea from S.S. *Indiana*.

June 4—*City of Omaha*—Mate injured as he fell. Taken to hospital on Shipping Board vessel.

June 8—*New York City*—Injured seaman taken to hospital.

May 29—*City of Omaha*—Radio operator sick. Shipping Board boat and doctor called.

May 26—*Sherman*—Injured man. Assistance given.

May 25—*Tuckahoe*—Injured man. Assistance given.

April 4—*West Hombrie*—Chief engineer sick. Treated from S.S. *Pocahontas*.

In all of these cases treatment could not be given on the ship as the members of the crew were without medical or surgical training and were at a loss to administer to the stricken men. By the means of wireless they were properly cared for and in most cases entirely recovered.

The coastal stations and hospitals designated to furnish the services in question are listed.

Chatham, Mass., U. S. A., WCC; Siasconset, Mass., U. S. A., WSC; New York City (Bush Terminal), N. Y., WNY; U. S. Marine Hospital, No. 70, 67 Hudson Street, New York City. Alternates: Hospitals Nos. 38, 43, 61.

Cape May, N. J., U. S. A.—WCY; U. S. Veterans' Hospital, No. 49 Gray's Ferry Road and 24th Street, Philadelphia, Pa. Alternate: U. S. Veterans' Hospital, No. 56, Fort McHenry, Baltimore, Md.

San Francisco, Cal., U. S. A.—KPH; U. S. Marine Hospital, No. 19 14th Avenue and Lake Street, San Francisco, Cal. Alternate: U.S.Veterans' Hospital, No. 24 Palo Alto, Cal.

Ships desiring medical advice can secure prompt service by addressing radiograms to any of the above-mentioned coastal stations with which communication is established, such radiograms to be signed by the master and briefly state the symptoms of the person afflicted. The service given in reply by the hospitals will be phrased in language intelligible to the inexperienced person.

A Honeycomb Coil Receiver with Detector and Amplifier

(*Continued from page* 454)

the amplifier tubes, although 90 volts brought in music and speech clearly and loudly enough to be heard and understood distinctly in any part of the auditorium, which is 100′ x150′.

Description and tuning of set follows:

The antenna used is of single wire, seven-strand copper 225′ long, 55′ high with an 8″ cage lead-in composed of 6 wires. The cage lead-in is not essential, but I found that signals came in a little better with it.

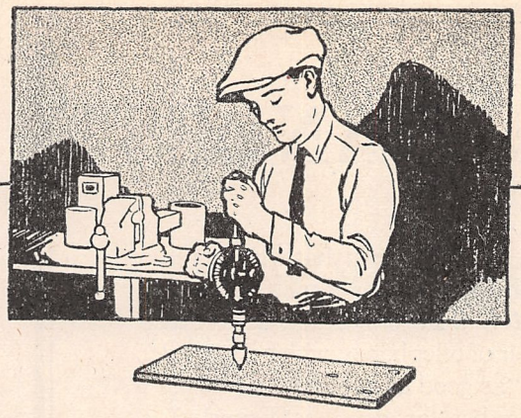
Panel—¼″x11″x18″, bakelite or formica.

Shelf for tube sockets and transformers 5/16″x4⅝″x7½″. The tubular grid leak is also mounted on this shelf back of the detector socket. Transformers are hung from the bottom of the shelf 3½″ from the center of one to the other. The first stage uses an R.C. of A.U.V. 712, the second is a Federal, mounted so the core is at right angles to the first transformer.

The remainder of the set can be assembled by referring to the drawings.

List of units:

1 L. C. 100 Geared Coil Mounting
1 Series—Parallel Switch
1 Primary Condenser, .0015 Mfd.
1 Secondary Condenser, .001 Mfd.
1 Grid Condenser, .0005 Mfd.



Ask About Formica!

FORMICA is known by the satisfaction it has given those who use and know radio insulation.

They will tell you it is the best insulating material—water-proof, warp-proof, splendidly finished in natural brown color or black—and absolutely efficient in its insulation effect.

Don't believe that all radio insulating materials are alike. There is a difference in the scientifically prepared and chosen fibre base from which Formica is made. There is a difference in the uniform excellence of the binder. In Formica it is always the same and always right. Formica processes are controlled with the utmost accuracy to produce an "always-good" product.

Good manufacturing has made Formica the most popular of all radio insulating materials.

It is approved by the navy and signal corps. Insist on it.

Dealers: Our greatly enlarged plant is now in full operation. We are shipping twice as much Formica as we were a few weeks ago. There is no reason now why you can't handle the best radio insulating material—and benefit by the unusual co-operation the company gives its dealers.

THE FORMICA INSULATION COMPANY
4618 SPRING GROVE AVENUE
CINCINNATI, O.

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FORMICA
Made from Anhydrous Redmanol Resins
SHEETS TUBES RODS

"As good as BRANDES"

Matched Tone is a trade-mark registered in the U. S. Patent Office.

It often happens that when a radio enthusiast asks for a Brandes ***Matched Tone*** headset, he is offered a pair of telephones, which, he is told, are "as good as Brandes."

To be "as good as Brandes" a headset must have behind it the cumulative experience of fourteen years—an experience which reflects itself not only in the high quality and super-sensitiveness and ruggedness of Brandes ***Matched Tone*** headsets but also in a remarkably low price. Fourteen years' experience is not acquired in a week or two.

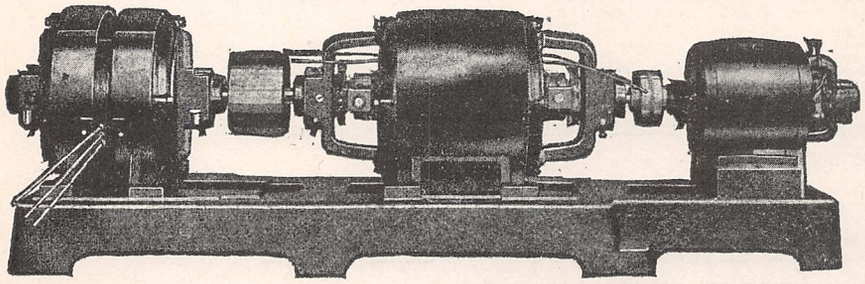
C. BRANDES, Inc.

Wireless Headset Specialists

237 LAFAYETTE STREET Dept. RN NEW YORK CITY

TRADE **ESCO** MARK

HIGH VOLTAGE MOTOR-GENERATORS STAND PRE-EMINENT IN WIRELESS FIELD



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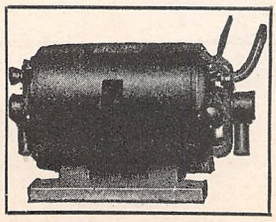
ESCO

Manufactures Over 200 Different Combinations of Windings for Wireless and Develops Special Apparatus for Special Requirements. Send Us Your Problems

Write for Bulletin No. 237—Complete Information

MOTORS—DYNAMOTORS—GENERATORS—MOTOR-GENERATORS

SOLD BY PRINCIPAL DEALERS EVERYWHERE



ELECTRIC SPECIALTY CO.

211 SOUTH STREET

STAMFORD CONN., U. S. A.

1 Bridging Condenser, .001 Mfd.
3 Murdock Sockets
1 Tubular Grid Leak and Base
8 Binding Posts
1 U. V. 712 Transformer
1 Federal 226 W. Transformer
3 Rheostats
3 Telephone Jacks
1 "A" Battery Switch
1 U. V. 200 or A. P. Electron Relay
2 A. P. V. T.
2 D. L. Coils— 25
1 D. L. Coil — 35
1 D. L. Coil — 50
1 D. L. Coil — 75
2 D. L. Coils—150

With these coils, stations up to 3,000 meters may be heard. For longer wave-lengths, other coils must be used, from 250 to 1,500.

Cabinet is made of black walnut, inside dimensions 6" deep by 11" high by 18" long.

In tuning for broadcasting stations from 250 to 450 meters, use D. L. 25 primary, 50 secondary, 35 tickler. The tickler is closely coupled to secondary, and tuning is done with primary coil and secondary condenser. After becoming accustomed to the set, all tuning up to 1,000 meters can be accomplished with secondary condenser. For stations below 250 meters, tune with tickler coil and primary condenser. Secondary condenser should be all out.

Grid and bridging condensers are all in except when tuning for long distance, in which case, adjusting the grid and bridging the condensers is necessary.

These directions may not apply to all locations or antennæ, but are correct where an antenna of the length given is used.

A Miniature Wavemeter

(*Continued from page* 457)

leads seen in the side and end views. These leads are brought to the condenser and lamp terminals, to which they connect through holes in the side of the wavemeter box, also seen in the side and end views. The method of mounting the coil will be of interest. It is connected to the top panel of the wavemeter box by means of small piano hinges seen in the side view. Thus the coil is capable of being rotated through an angle of 90 degrees. This was done to serve two objects: In the first place, by thus being able to rotate the coil through this angle, variation in coupling between wavemeter and oscillation source could be obtained; in the second place, this method of mounting was designed to contribute to the compactness of the wavemeter. It will be seen from the drawings that the coil form has a two-inch hole cut in the center. When the coil is rotated 90 degrees from the position in which it appears in the drawing, the coil lies flat on the top wavemeter panel, since the condenser knob fits in the hole in the coil form. Thus when not in use this wavemeter occupies an absolute minimum of space. It will be evident that the coil leads are made flexible to permit of this rotation of the coil.

The size of holes to be drilled, if not shown, are of course to be made in proportion to the entire wavemeter size.

The set is easy to build, costs hardly anything, since the parts will probably be found lying around any amateur's house, and will be found to give excellent results.

An Efficient Chopper for I.C.W.

(*Continued from page* 457)

gap and connects them together. An opening was made in the moulded substance on the front of the disk by using a hot soldering iron to melt the composition, exposing a narrow strip of metal all around the disk.

This is station K.S.&S.Co.

Broadcasting
Better Radio Equipment

First—A Short Talk on Kellogg Head Set Superiority

Kellogg head sets are the lightest on the market which is a prime requisite for comfort in any Radio receiving. They are built of highest quality material and their design is based on 25 years' engineering experience in telephone receiver construction. Kellogg head sets are supplied under the following codes and resistances: No. 69A, 2400 ohms, including head band and 6 foot cord; No. 69C, 2000 ohms, including head band and 5 foot cord; No. 74A, 1000 ohms single receiver with head band and 5 foot cord. Kellogg head sets are adapted for use by campers with portable receivers.

Second—A Brief Description of Kellogg Jacks and Plugs

Kellogg Radio jacks likewise are a standard product, once installed in your set, will give service and last indefinitely. Hundreds of thousands of Kellogg jacks and plugs in telephone work are in service the world over. They are designed for all standard Radio practice with the following codes: No. 501 is a four-conductor, two break type; No. 502 is a two-conductor open circuit type; No. 503 is a three-conductor, single break type; No. 504 is a four conductor, single make contact type; No. 505 is a six-conductor, one make, two break type.

Third—Why You Should Use Kellogg Grid Leaks and Condensers

Because first of all, they are accurate—no variation, regardless of atmospheric conditions, insuring uniform receiving.

Fourth—The Reliability of Kellogg Transmitters

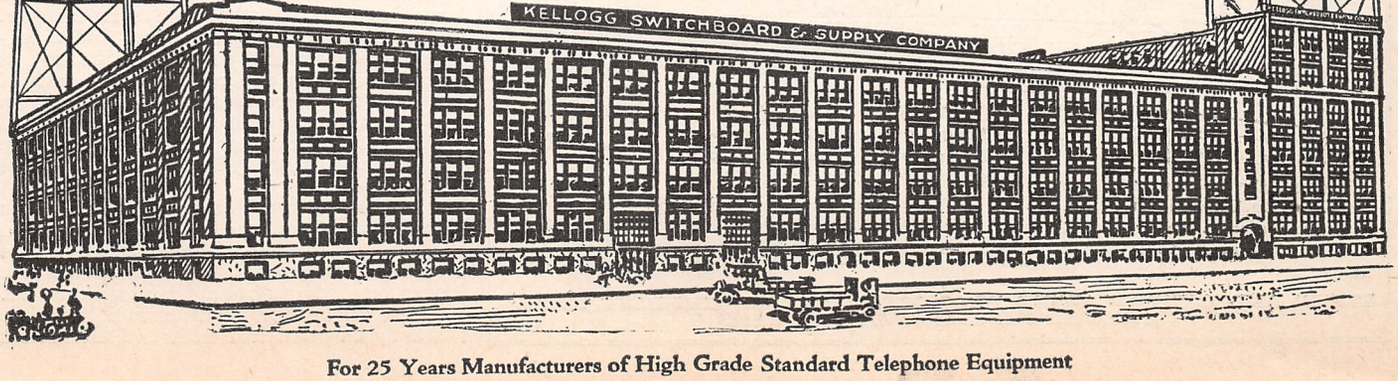
Kellogg Company transmitter or microphone is proving exceptionally reliable in Radio work. Today there are over three million Kellogg telephone transmitters in service, and their record is unsurpassed.

Fifth—Kellogg tube sockets are built of Kellogg Bakelite, and a standard product easily installed.

Write us today for our Kellogg Radio bulletin, completely listing our supplies, which include insulators, batteries, arresters, etc.; and investigate the latest Kellogg Radio products, every one of which is designed and built on the basis that—Use, is the Test.

Kellogg Switchboard & Supply Co., Chicago

"Signing Off" until Next Issue



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EVERYTHING Radio!

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We have complete stocks of C. W. and spark transmitting apparatus, parts and supplies.

The Famous Grebe Receivers are our specialty.

We carry only the best in amateur Radio Equipment.

Order from your dealer.

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TRADE MARK REGISTERED

PHILADELPHIA WIRELESS SALES CORPORATION

Formerly Philadelphia School of Wireless Telegraphy

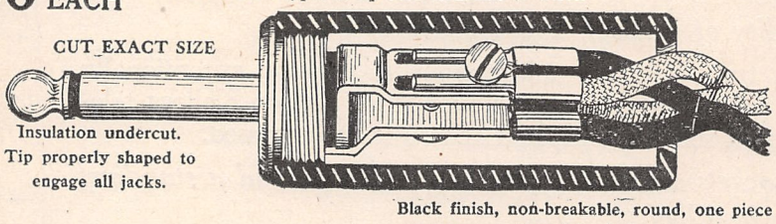
1533 PINE STREET PHILADELPHIA, PA.

Carter *TU-WAY* Radio Plug

PRICE $1.50 EACH

Special designed terminal permits TWO phone sets to be connected at the same time. Positive contact made with ALL types of tip cord terminals or wires.

CUT EXACT SIZE



Insulation undercut. Tip properly shaped to engage all jacks.

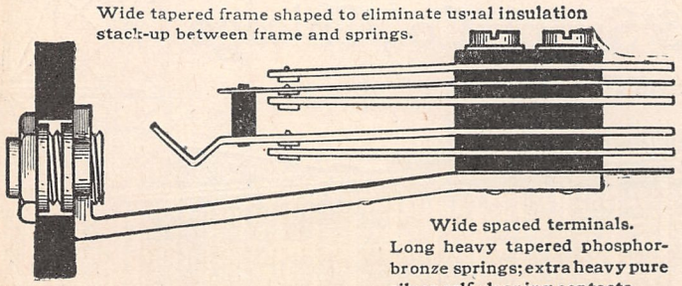
Black finish, non-breakable, round, one piece handle not affected by body capacity; no screws used to hold handle in place.

Carter *HOLD-TITE* Radio Jack

PRICE $1.10 EACH

CUT EXACT SIZE OF No. 105 AUTOMATIC FILAMENT CONTROL JACK

Wide tapered frame shaped to eliminate usual insulation stack-up between frame and springs.



Wide spaced terminals. Long heavy tapered phosphor-bronze springs; extra heavy pure silver self-cleaning contacts.

Other Combinations, 1 to 4 Springs, 70c to $1.00 EACH

The only jack which mounts on ⅛-in. to ¼-in. panels without spacer washers or screws. Adjustable lock-nut feature prevents improper mounting.

Carter Radio Co. 209 S. STATE STREET CHICAGO

THESE AND OTHER CARTER PRODUCTS SOLD BY THE BEST KNOWN ELECTRICAL AND RADIO JOBBERS

This gave a good smooth metal surface for a brush to connect with and one was mounted so as to make contact with it, the other being left to rub on the edge. This greatly reduced the resistance and increased the radiation to 1.4 amperes when using chopped C.W.

This home-made chopper is in use at station 8AMQ, and is giving good results. The advantages of I.C.W. are being appreciated more and more by those who have trouble raising a station due to the sharpness of the wave emitted by a C.W. set. The use of a chopper broadens the wave considerably and this kind of modulation will probably be used entirely in the high power C.W. set of the near future.

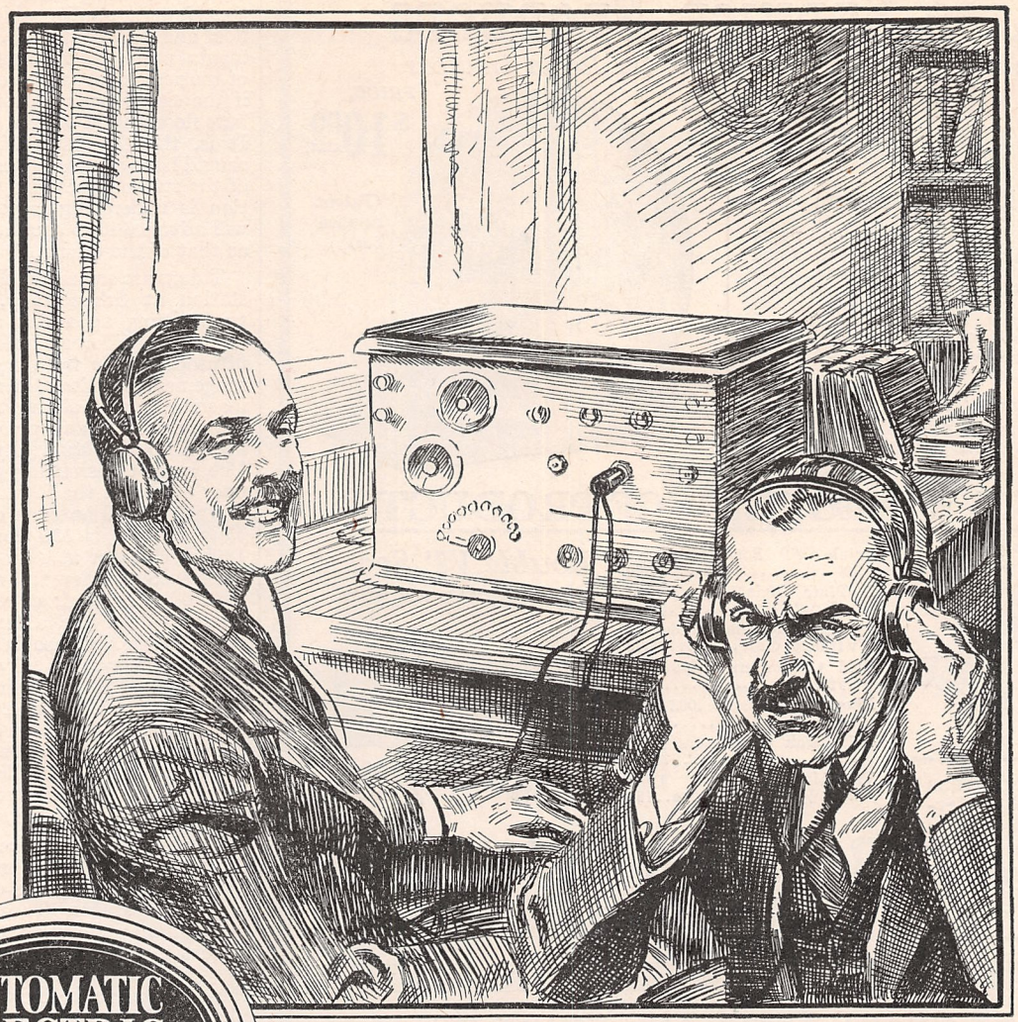
Broadcasting Methods

(*Continued from page* 421)

ance with air traffic regulations, and with a view to giving a variety of entertainment and instruction. This program usually consists of agricultural reports and prices, opening prices on stocks and bonds, weather forecast and standard time signals, interspersed with music, during the morning. Then come mid-day prices on stocks and bonds, shipping news, sporting scores and results, fashion news, more weather forecasts, agricultural reports and prices, shipping news, closing market prices and music in the afternoon. The evening is devoted to concerts, recitals, lectures, stories, talks, final scores, etc. A special feature of the WJZ program is the "Man in the Moon" stories for children every Tuesday and Friday, and the literary evenings conducted by the editorial staffs of several New York publications. The concerts heretofore have been of a high order, but lately, due to an inability to secure high-class talent because of the aversion of artists to give their services gratis, it has been impossible to maintain the former standard. WJZ broadcasted the first grand opera and the first operetta. The former was Mozart's "The Impresario," presented by William Wade Hinshaw, and the latter, C. E. LeMassena's "Pandora," presented by the composer. The time signals from Arlington are received by a standard Westinghouse medium wave receiver, using a long single-wire antenna and transferred electrically to the radiotelephone transmitter. This enables those with short-wave receivers to pick up the message. All stations have radio chapel services on Sunday, some in the morning, others in the afternoon. In addition to the sermon by a well-known preacher, there is usually excellent music by a choir and soloists, all of which is impressive and indispensable as a counteraction against Sabbath desecration. This is one of the most beneficial instrumentalities of radio service, and its influence for good is incalculable.

Upon arrival at the Newark station the artist is received by the announcer. If the artist be a woman she is introduced to the lady attendant, who looks after her comfort and entertainment. Artists are accorded every courtesy and instructed beforehand regarding the points to be observed after entering the broadcasting studio. It is the custom of the Westinghouse to defray all expenses, including transportation. Programs are arranged on schedule far in advance. There is a booking department and a canvassing department under the direction of experts. When one considers that each of the seven days requires a diversified program of ten to a dozen different items, with several cancellations and changes entering into the day's work, the magnitude of the enterprise is apparent.

In East Pittsburgh a single Westinghouse condenser microphone of two stretched steel diaphragms is used. The announcer in the studio is in constant communication with the operator on the roof, as at the Newark station. Artists are brought into the studio, which is heavily carpeted and with two thicknesses



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LONG RANGE
RADIO
HEAD SETS

Ask your dealer. If he cannot supply you, we will send you at once an Automatic Electric Head Set for

$10.00 Postpaid

With plug attached, $11.50

One Smiles; Another Frowns — Why?

THE man with the smile is enjoying a radio musical program through an Automatic Electric Head Set. Scientific design and careful manufacture assures him loud and distinct reproduction without distortion or foreign noises. These are qualities that are seldom found in receivers that are carelessly designed, or in which high resistance is given first importance.

The Automatic Electric Head Set was designed and perfected by a staff of engineers who have had more than thirty years of experience in the development of telephone talking apparatus. It is made in only one style and resistance,—the one proven by careful experiment to be the most efficient under all conditions.

The Automatic Electric receiver is designed with a single powerful electro-magnet which takes effect at the exact center of the diaphragm. This produces concentric vibrations, avoiding all distortion and false overtones. The coil is wound on a cylindrical core. The absence of sharp corners gives practical immunity from short-circuited turns—even after long continued use.

Whether used with crystal or vacuum tube detectors, multi-stage amplifiers or loud speakers, all signals are reproduced with maximum loudness and clearness.

This is the high grade plug that comes attached, when desired, to *Automatic Electric Head Sets*. It will take care of any kind of cord terminals, will fit any kind of jack and will accommodate two head sets. With this plug attached to our head set you can be sure the head set is properly "poled."

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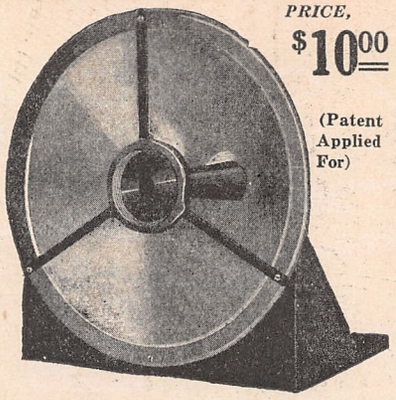

PRICE, **$10.00**

(Patent Applied For)

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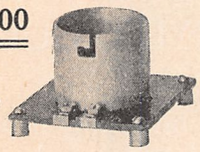
Single VT Socket

$1.00



Type S10

Triple VT Sockets Type S4 ..... $3.00

23 Plate Variable Condenser without dial..... $3.00

43 Plate Variable Condenser without dial..... $3.75

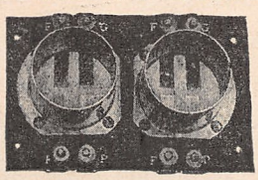
Grid Condensers .0005 mf. Type S15..... 35c

Phone Condensers .002 mf. Type S16..... 35c

Grid Leak Condensers Type S30 ..... 50c

Variable Grid Leak Type S40, ½ to 3 megohms.. 75c

Double VT Socket



Type S3 **$2.00**

We carry numerous other types of interest to Radio dealers and wireless men. Radio Service Products are for sale by all reliable dealers.

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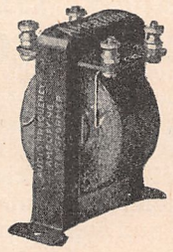
THE CHART TELLS THE STORY OF

THE AMERTRAN



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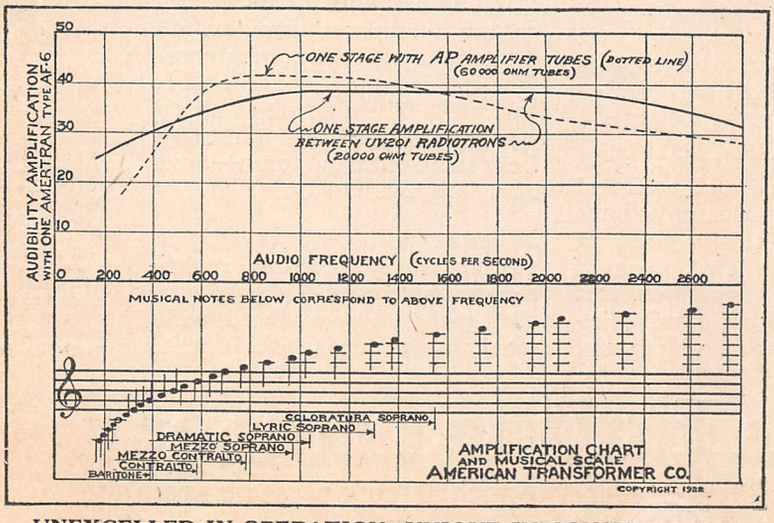
which has been recently developed to meet the critical demand of discriminating radio engineers.

NOTE the amplification curve in the chart below compared with musical scale frequencies—plotted from actual and authentic tests.

Highest Amplification Constant Over Broadest Band of Frequencies—Absolutely Without Distortion or Resonance Peaks.



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of burlap on walls, similar to the recording room for making records. This differs from the Newark studio, which has rugs on the floor and undraped walls. One of the fundamental principles of acoustics is that intensity of musical tones is appreciably strengthened if the singer or instrumentalist stands on a bare floor and in a place devoid of draperies. It is, therefore, surprising that this point should have apparently escaped the attention of the studio directors. The Springfield station is undergoing important changes that will advance it to a position as commanding as that of the others.

Things are somewhat different at the WGY station at Schenectady, where the radio-transmitting apparatus and the studio are located in different buildings, about three-fifths of a mile from each other. This arrangement permits of considerable flexibility, inasmuch as it allows the broadcasting of programs from any point that can be connected to the studio by a telephone line. The main transmitting plant is on the top floor of one of the factory buildings, with a multiple-tuned antenna erected on the roof. This antenna is 350′ long, supported by a 180′ steel tower at each end. The counterpoise system, a few feet above the roof, consists of a network of wires that act as a "ground" for the antenna, resulting in a considerable decrease in effective resistance of the entire system. Two fundamental conditions for the successful operation of the radio-telephone transmitter—high frequency energy and its control in accordance with the audible vibrations to be transmitted—have been successfully fulfilled by the General Electric Co. at this station. The wave-length is also 360 meters.

Three rooms are utilized at the studio: one for reception, one for musical instruments and one containing the controlling and amplifying apparatus. The only electrical mechanism in the performing room are small microphones mounted on movable stands so that they may be placed in the best position for the selection to be broadcasted. These implements have been carefully designed with a view to clearly reproducing the true tone qualities of the music. The minute electric currents, which are set up in the microphone, are first transferred to the amplifying room. Here the intensity of the transmitted selection is varied at will by means of various controls on the amplifiers. At the output terminals of the last amplifier, an electric current that varies in accordance with the sound waves impressed on the microphone, is available and is transmitted, over a pair of wires, to the modulator tubes at the main station.

Censorship and supervision is exercised by those in charge. The studio director is able to cut off the microphones in or out of the circuit by means of a control switch. The illumination of a red lamp, as soon as the switch is closed, is the signal for quiet as the great invisible audience is then in contact with the studio. The censor is stationed in the apparatus room. He listens to everything that enters the microphone and makes such adjustments as he deems necessary to improve the tone quality. He is also in telephone communication with the transmitting department, which maintains a constant watch on the operator, who likewise keeps a sharp eye on his apparatus. All circuit adjustments are under control of the censor and no changes may be made without his consent. For broadcasting events that enlist the services of a number of participants, several microphones are used in parallel. The positions of the artists and the tonal variations are directed by a series of cards with such phrases as, "Please Sing More Softly," "Please Stand Nearer Microphone," "Please Enunciate More Clearly," etc. This station has found that the string quartet or the small symphony orchestra is reproduced the most perfectly, while the brass band is one of the difficult problems because of its "edge" in brilliant effects, but cornet, trombone and saxophone solos go over the radio in excellent

(*Continued on page* 505)

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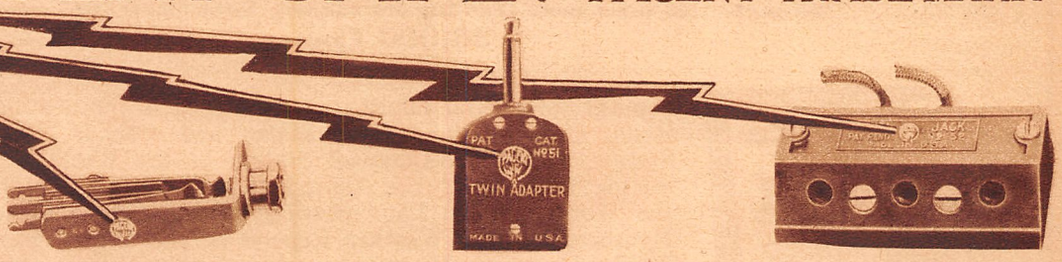
PLAY SAFE! LOOK ~ FOR ~ THE PACENT TRADE MARK



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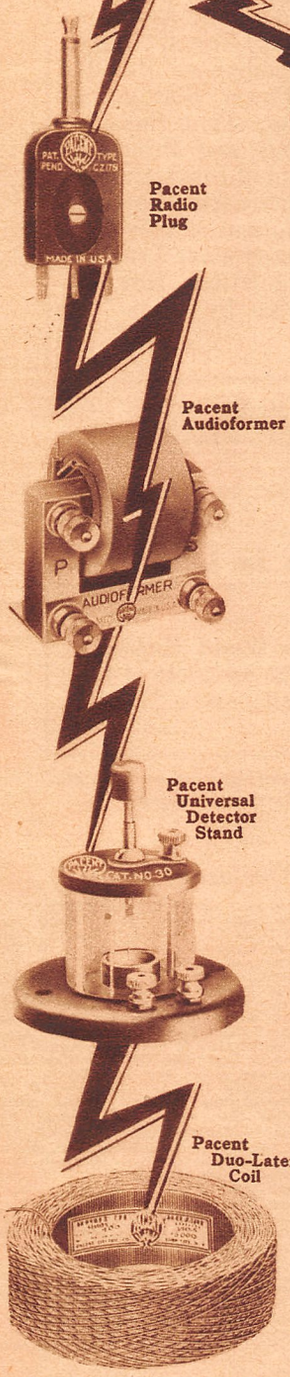

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In the ordinary purchases which you make every day, you invariably depend upon some mark of quality as an assurance of value and satisfaction. In buying radio materials the average purchaser is a great deal more dependent upon the reputation of the manufacturer than in buying everyday commodities. A radio instrument may look good and act bad. How much more important it is in this case, therefore, to look for the trademark of a competent, dependable manufacturer. The Pacent trademark on any radio products is an absolute assurance of satisfaction.

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It means that the device bearing this trademark was made to fill a definite, important radio need: that is the meaning of PACENT RADIO ESSENTIALS.

It means that the product was originated by a radio expert and has passed the acid test of experience. The Pacent Universal Plug was the *first* radio plug; the Pacent Jacks were the first radio jacks, and so with the Twin Adapter, Multi-jack and other PACENT RADIO ESSENTIALS. Every Pacent product is also backed up with Mr. Pacent's fifteen years personal experience in the radio industry.

The Pacent trademark means that the product is one of a group generally recognized by radio authorities as leaders in their line. Pacent jacks and plugs are standard with the largest radio manufacturers. Pacent Duo-lateral Coils, besides being used in standard sets of wide distribution, were approved and used by Major Armstrong as important elements in his new super-regenerative circuit, together with other Pacent products. All PACENT RADIO ESSENTIALS are also approved and sold by the leading radio distributors.

Therefore, when you buy PACENT RADIO ESSENTIALS bearing the Pacent trademark you are absolutely sure that you are getting the best for your money. You are playing *safe*. Don't accept substitutes, imitations or something "just as good." Insist on seeing the Pacent trademark.

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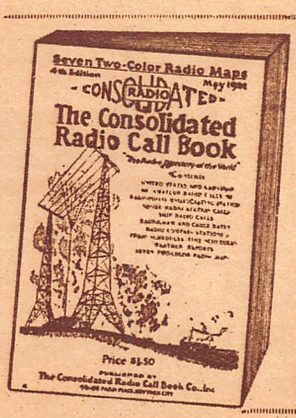

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F115 5 Watt Transmitter.... 8.00

FILAMENT CONTROL RHEOSTATS

Crosley—Wound on vulcanized fiber. Adjustable to any panel. Complete with knob. F130 Each..... 54c

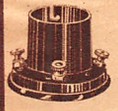
Best made. High heat resisting base. Diam. 2⅛ in. 1½ amp. Resist, 6 ohms. 1¼ in. Knob with pointer. F132, each... 78c

F133 Potentiometer.....$1.18
F135 Vernier Rheostat..... 1.18

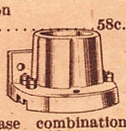
Rheostat to handle two tubes. Cap. 3 amp. Resist. 6 ohms, complete with 1⅜ in. knob and pointer, F134, each.....$1.45

Signal Porcelain Base Rheostat for table mounting. Resist, 10 ohms. F136, each, 87c

VACUUM TUBE SOCKETS



Our Special Socket. A wonderful value. Moulded entirely of Bakelite. Four binding post connection F140, each.....58c.



Porcelain Base and Tube F144 **Crosley** for either panel or table mounting.....45c

Bakelite Base combination type for panel or table mounting. F146, each.....69c

VARIABLE GRID LEAK

Pencil mark type. Resistance may be varied exactly as needed. F160, each.....24c

GRID CONDENSER

F162 Mounting holes spaced to fit lugs of above leak. Cap. .00025 MF.....19c
F163 Same as 162 but higher grade. Enclosed in metal case.....39c

BAKELITE DIAL AND KNOB

Neat, clean cut design. Clear, plain engraved scale, with enameled white letters contrasting with polished black finish of dial. Fluted knob. F902 For 3/16 inch shaft. Each 69c; Dozen $7.20.
F903 For ¼ inch shaft. Each 69c; Dozen $7.20.

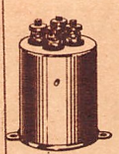
DIAL AND KNOB

A fine looking knob and dial moulded in one piece. Neat, clean cut design. Polished black finish. Clear, plain engraved scale with numbers and lines in contrasting white enamel. Ribbed knob that fits the hand. The two sizes used on the same panel can be arranged to produce a very attractive effect.
F904 Three inch diameter for 3/16 inch shaft. Each 48c; Dozen $5.40.
F905 Three inch diameter for ¼ inch shaft. Each 48c; Dozen $5.40.
F906 Four inch diameter for 3/16 inch shaft. Each 80c; Dozen $9.00.
F907 Four inch diameter for ¼ inch shaft. Each 80c; Dozen, $9.00.

FIXED CONDENSERS

Moulded cases, nickeled binding posts.
F802 .005 Mfd. Each..49c
F804 .01 Mfd. Each..59c

RADIO FREQUENCY AMPLIFYING TRANSFORMER



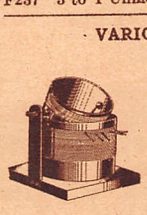
This transformer will get the long distance stations loud and clear. Permits of easy, sharp tuning. Helps cut out static and interference. Makes your set sensitive enough to use a loop aerial. Enclosed in metal case affording perfect shielding. Suitable for panel or base mounting. Because of its special design can be mounted in any V. T. socket. Works with any make of tube. Wave ranges 150 to 550 meters. Wiring diagrams included. F995 Each.....$4.50

OUR SPECIAL AUDIO FREQUENCY AMPLIFYING TRANSFORMERS

We believe these transformers to be the best on the market. We offer them with two winding ratios—the 10 to 1 for Radiotrons and Cunninghams—the 3 to 1 for A. P. Moorehead. These two types of tubes have entirely different characteristics and therefore require transformers of different winding ratios. As high as three stages can be used without howling due to proper impedance ratio, minimum distributed capacity, low core losses and proper insulation. Mounted style has bakelite panel with binding post connections. Unmounted has core and coils assembled with two holes in core for fastening to apparatus.

F234 10 to 1 Mounted, each.....$3.95
F235 10 to 1 Unmounted, each..... 3.20
F236 3 to 1 Mounted, each..... 3.90
F237 3 to 1 Unmounted, each..... 3.10

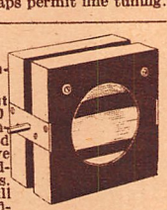
VARIO-COUPLER



F415 Price, complete assembled, $3.60

F416 Not assembled but all parts complete, $1.40 With this loose coupler and two variometers together with the necessary other parts a highly efficient tuning set can be made. Easily mounted on panel. Windings on formica tubes. Inductively coupled for 180 to 600 meters. Multiple taps permit fine tuning.

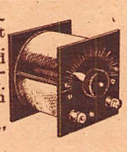
VARIOMETER



F410—Completely assembled, price $3.75

F411 Not assembled but all parts complete, $1.90 Perfect in design and construction. Accurate wood forms. Correct inductive ratios. Solid baked windings. Positive contacts. Highest efficiency. Will operate perfectly indefinitely. This variometer will equal in results most of the moulded variometers selling at much higher prices.

VARIABLE CONDENSER



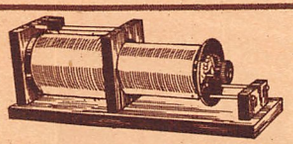
One of the best made condensers. One of the few that will stand up on C.W. work. Rigid, accurately spaced plates. Formica ends. Engraved scale. Clear glass case. Perfectly set aluminum plates.
F806 43 plate .001 Mfd., $3.95.
F808 21 plate .0005 Mfd., $3.60.

PANEL MOUNTING TYPE

Notice our very low prices on this high grade condenser for panel mounting. Mechanically perfect. Guaranteed to suit you or your money back. No knobs nor dials included.
F812 43 plate .001 Mfd.$2.95
F813 21 plate .0005 Mfd. 2.55
F814 11 plate .00025 Mfd. 2.15
F815 3 plate Vernier.... 1.85

KNOCKED DOWN VARIABLE CONDENSERS

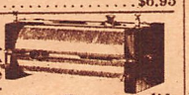
You can save money by assembling your own condensers. Formica top and base. Complete with all parts not assembled.
F820 41 plate .001 Mfd.....$2.48
F821 21 plate .0005 Mfd..... 1.88



ARLINGTON RECEIVING TRANSFORMER

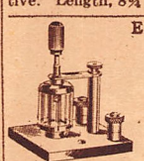
Will tune in all stations up to 3,500 meters. Very efficient on short waves and for radiophone reception. Used with our Detector Two Step Amplifier it produces very excellent results. Also does good work with crystal detector. Silk covered windings on formica tubes. Very fine mahogany finish wood work. Base size 6x18 inches. Slider controls primary, 12 point switch on secondary. Can be tuned very close. A wonderful value at our price. F720 Price.....$6.95

TUNING COIL



Range up to 950 meters. Wound with bare copper wire, machine spaced. Ends of mahogany finished hard wood. Two easy sliding contacts on polished brass rods, four binding posts. Substantial, efficient, attractive. Length, 8¾ in. F722, price.....$2.45

ENCLOSED DETECTOR



One of the finest crystal detectors on the market. Crystal mounting enclosed in heavy glass shield. Quick, positive adjustment. Brass parts polished nickel finish. F730 Each.....$1.89

GALENA DETECTOR

Easy fine adjustment. Crystal mounting cup. Moulded base and knob. Brass parts polished nickel finish. F732 Each.....98c

Detector Crystals Carefully Tested
F736 Galena, Arlington tested, per piece...22c
F738 Silicon, Arlington tested, per piece...22c
F735 Buzzer tested, Galena, per piece...12c
F737 Buzzer tested, Silicon, per piece....12c

HEAD SETS "PHONES"

Double sets complete with head bands connecting cord.
F751 Murdock No. 56, 2000 ohm., $4.85.
F752 Murdock No. 56, 3000 ohm., $5.80.
F756 Brandes Superior, 2000 ohm., $7.60.
F758 Western Electric, 2200 ohm., $12.00.
F760 Barawik, 2000 ohm., $3.95.
F762 Barawik, 3000 ohm., $4.95.

INDUCTANCE COILS

Carefully made—fine looking coils. Highest efficiency. Low distributed capacity effect, low resistance—high self inductance. Very firm enamel impregnation. Range given is in meters when varied with .001 variable condenser. Mounted coils have standard plug mountings.

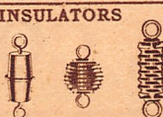
Turns	Range	Art. No.	Price Not Mntd.	Art. No.	Price Mntd
25	120- 250	F301	35c	F320	$0.85
35	175- 450	F302	40c	F322	0.90
50	240- 720	F303	45c	F323	0.95
75	390- 910	F304	48c	F324	0.98
100	500- 1450	F305	53c	F325	1.03
150	600- 2000	F306	60c	F326	1.10
200	900- 2500	F307	64c	F327	1.14
250	1200- 3500	F308	68c	F328	1.18
300	1500- 4500	F309	72c	F329	1.22
400	2000- 5000	F310	76c	F330	1.26
500	2800- 6100	F311	80c	F331	1.30
600	4000-10000	F312	94c	F332	1.44
750	5000-12000	F313	$1.08	F333	1.58
1000	7900-15000	F314	1.32	F344	1.82
1250	9750-19500	F315	1.60	F335	2.10
1500	14500-26500	F316	1.95	F336	2.45

ANTENNA WIRE

Solid Bare Copper Wire size 14
F240 100 ft. coil 45c F242 500 ft. coil $2.15
Solid Bare Copper Wire size 12
F244 100 ft. coil 72c F246 500 ft. coil $2.85
Seven Strands No. 22 Copper Wire Cabeled
F248 100 ft. coil 94c F249 500 ft. coil $4.25

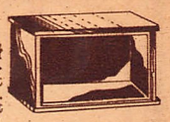
ANTENNA INSULATORS

F260 Size 1x3¼. Two for.....35c
F262 Size 2⅛x 3¼. Two for...58c
F264 Size 1½x4. Two for.....80c
F266 Size 1½x 10½. Two for..$1.35



F260 F262 F264-6

CABINETS



Fine looking cabinets, solidly built. Made of genuine solid mahogany in elegant hand rubbed finish. Hinged tops. Front rabbeted to take panels. Panels not included. Prices are, Transportation paid.

Panel Size	Inside Dimensions High	Wide	Deep	Art. No.	Price Each
6x7′	5½′	6½′	7′	F420	$2.48
6x10½′	5½′	10′	7′	F422	2.75
6x14′	5½′	13½′	7′	F424	3.30
7x18′	6½′	17½′	7′	F426	3.90
6x21′	5½′	20½′	7′	F425	3.90
9x14′	8½′	13½′	10′	F428	3.70
12x14′	11½′	13½′	10′	F430	4.40
12x21′	11½′	20½′	7′	F432	5.25

SOLID GENUINE CONDENSITE CELORON PANELS

Notice our very low prices on this fine quality grade 10 genuine solid sheet Condensite Celeron (a product with mechanical, chemical and electrical properties like formica and bakelite). Machines well without chipping. Won't warp. Waterproof. Highest mechanical and di-electric strength. Attractive natural polished. Black finish which can be sanded and oiled for extra fine work.

Panel Size	¼′ thick Art. No.	Price	3/16″ thick Art. No.	Price	¼′ thick Art. No.	Price
Inches						
6x7	F450	$0.50	F460	$0.75	F470	$0.98
6x10½	F451	.75	F461	1.18	F470	1.47
6x14	F452	1.05	F462	1.55	F472	2.05
7x18	F453	1.55	F463	2.30	F473	3.10
7x21	F457	1.78	F467	2.65	F477	3.60
9x14	F454	1.60	F464	2.30	F474	3.10
12x14	F455	2.10	F465	3.10	F475	4.15
12x21	F456	3.15	F466	4.65	F476	6.20

BINDING POSTS

Brass, polished nickel finish. Washer and 6/32′ screw extending ⅝′.
F370 Large size—barrel and knob ¼′ long, dozen.....95c
F372 Smaller size—barrel and knob 9/16′ long, dozen.....84c
F374 Large size with composition knob, dozen.....60c
F376 Large size with hole for phone tip or wire, dozen.....95c
F378 Small size with hole for phone tip or wire, dozen.....38c

SWITCH CONTACT POINTS

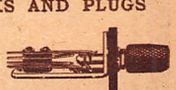
Brass, polished nickel finish. All have ⅜′ long size 6/32 screws. All prices the same, Two nuts for each point.
Dozen 20c Hundred $1.40
Order by Article Number.
F360 Head, ¼′ Diam., ¼′ High
F362 Head, 3/16′ Diam., ⅛′ High
F363 Head, 3/16′ Diam., 1/16′ High
Solder Lugs to Fit Contact Points
F365 Dozen 12c—Hundred 60c

SWITCH LEVERS

Moulded composition knob Exposed metal parts polished nickel finish. Wiping contact. Fitted with panel bushing, wire lug, spring and two setnuts. A high grade switch.
F380—1′ Radius. } Each 35c
F381—1¼′ Radius. }
F382—1½′ Radius. } Dozen $3.00

Switch lever stop. Brass, polished nickel finish. F386—Dozen 20c, hundred $1.40.

RADIO JACKS AND PLUGS

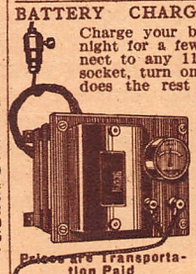


Jacks are polished nickel finish. Mount on panels ⅛ to ⅜ in. thick. Extend back of panel only 2-7/16 in. Silver contact points.

Jacks Only
F390 Open circuit, each..... 48c
F391 Closed circuit, each..... 59c
F392 Two circuit, each..... 72c
F393 Single circuit filament control..... 80c
F394 Two circuit filament control..... 99c

F395 Plug. Large space with set screws for attaching cord. Each..... 85c

BATTERY CHARGING RECTIFIER

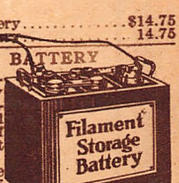


Charge your battery at home over night for a few cents. Simply connect to any 110 volt 60 cycle light socket, turn on current and rectifier does the rest automatically. Will work for years without attention. Simple connections. Gives a tapering charge which batteries should have. You can make it pay a profit charging your friends' auto batteries. Long connecting cords with pair of battery clips.

Prices are Transportation Paid

F201 For 6 volt battery.....$14.75
F203 For 12 volt battery..... 14.75

STORAGE BATTERY

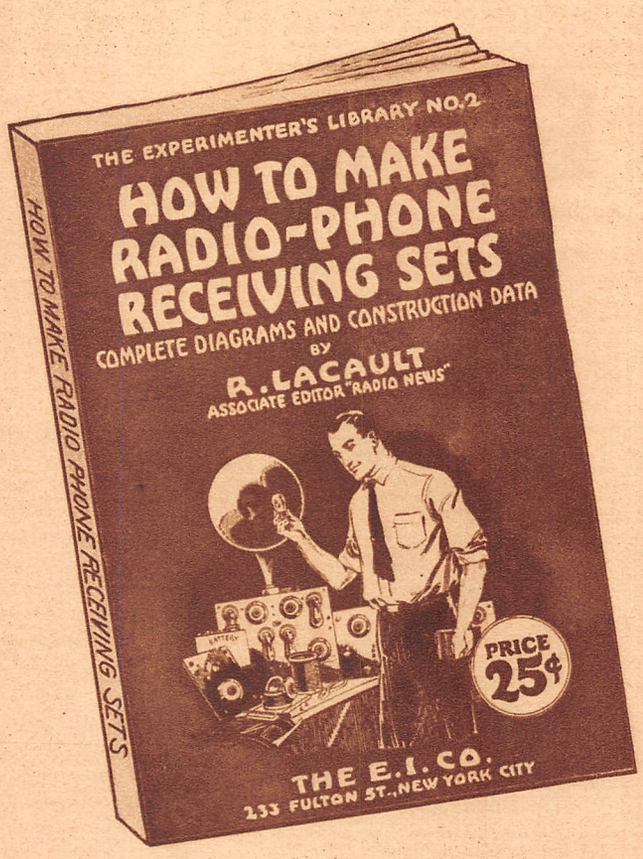


A very high grade battery made especially for radio service. Guaranteed. Properly cared for will give years of service for filament lighting.
F194 6 volt, 40 ampere size, each.....$10.95
F196 6 volt, 80 ampere size, each..... 13.75

Prices are Transportation Paid

THE BARAWIK CO. 102 South Canal Street CHICAGO, ILL.

Two New Ones for the Amateur



HOW TO MAKE A RADIO-PHONE RECEIVING SET

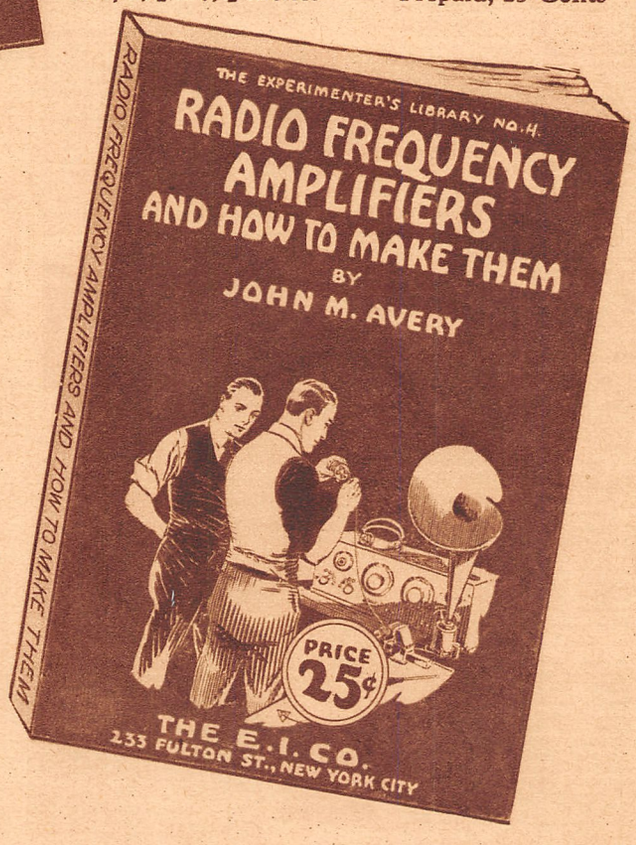
By

ROBERT E. LACAULT

Associate Editor RADIO NEWS

A NON-TECHNICAL book for the beginner. Gives complete constructional data on the building of a complete Crystal Detector Set, Tuning Coil, Loose Coupler and a Single Audion Tube Set with Amplifying Units. It furnishes all dimensions and working drawings of every part that must be constructed by the amateur. Written in plain, simple language that anyone can understand. The opening chapter gives a complete description of the theory of radio and tells what it's all about, teaching the principles of wireless so that the constructor knows what he is doing.

48 Pages, 26 Illustrations
Bound in Beautiful Two-Color Cover
Size, 5½ x 7½ inches Prepaid, 25 Cents



RADIO FREQUENCY AMPLIFIERS

AND HOW TO MAKE THEM

By

JOHN M. AVERY

THIS book is for the more advanced amateur, showing the construction of the Radio Frequency Amplifying Transformer and giving complete constructional data. It shows the application of Radio Frequency to amplifying units that the amateur may already possess and gives 15 hook-ups showing practically every use Radio Frequency Amplifying Transformers can be put to.

32 Pages, 15 Illustrations
Bound in Beautiful Two-Color Cover
Size, 5½ x 7½ inches Prepaid, 25 Cents

THE E. I. COMPANY

233 FULTON STREET
NEW YORK CITY, N.Y.

Broadcasting Methods

(*Continued from page* 500)

style. A ladies' quartet does not broadcast well unless the number be unaccompanied and the singers employ considerable softness of tone emission. Violinists, pianists and tenors are easily managed.

Probably the most unique broadcasting station is that in the heart of New York City, known as WWZ. It is a constant reminder of that enterprising, far-visioned American merchant—John Wanamaker. Back in 1911 he installed a Marconi wireless telegraph station on both stores, thereby establishing direct communication between New York and Philadelphia. In December, 1921, the toy department of the New York store added a small radio section. In March, 1922, this was removed to the seventh floor as an adjunct to the broadcasting station under the direction of D. C. Smith. This was publicly opened on April 4th last. A musical program has been rendered every day and evening since. All activities, other than technical, are in charge of J. Thurston Noe, assistant to Alexander Russell, concert director of the Wanamaker industries.

The program is arranged on a somewhat different order from others. It follows a definite scheme and carries out a prearranged plan. There is a diversity of entertainment, including music, literature, sports and miscellany. Every afternoon at 1.40, Edna Beatrice Bloom, official soprano soloist of the Auditorium, gives a brief recital of three or four songs. At 2.40 there is a short recital of music by the Ampico piano or the victrola. At 3.40 another song recital or talk. At 4.40 on Tuesday and Thursday, one may hear the latest news on fashions, and on Wednesday and Friday, the children's hour is conducted by Elsie Jean. Beginning at 10.30 an evening musical program is given, the lateness of the hour affording listeners an opportunity to hear clearly, as all other stations are out of the air.

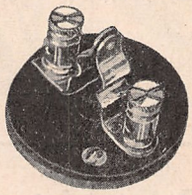
The concert broadcasting room is in the South building, on the auditorium floor. It contains a grand piano, an upright piano, a phonograph, the transmission set and appropriate furniture. It is of ample size for ordinary use and is encased in curtains. Instead of the familiar microphone, a pair of telephones are used. A small megaphone is inserted in the mouthpiece of the phone that stands on the switchboard box. The other phone may be shifted about to convenient points, being equipped with an extra long cord. In broadcasting piano music, this second phone is placed on a bench near the piano. The aim of the department is to develop radio service of a high standard, including timely discourses on interesting subjects. No effort is wasted on trivial experimenting. Applicants must pass a rigid test or be well recommended before they are granted permission to sing, play or speak. Auditions are frequently held in the Auditorium in order to ascertain the qualifications of the applicant, while others are drawn upon by reason of their having made successful appearances at Auditorium concerts. Radio Director Noe is a musician as well as a radio expert, with an intimate knowledge of the wishes of the music department and also of the Wanamaker policy, which permits of nothing mediocre or cheap. Therefore WWZ entertainments are of a quality in keeping with such standards.

The great organ dedicated in November, 1921, by two of the world's leading organists, is in line for broadcasting purposes. Experiments have been made as to its availability for transmitting the tones of this wonderful instrument via radio, but to date the results have been unsatisfactory. This furnishes one of the problems that probably will be solved in the near future and will give the station a distinct position among broadcasters. The big organ, located in the Philadelphia Wanamaker store, will also be used for radio broad-

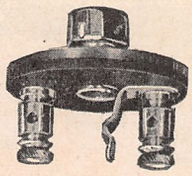
"Improved" Radio Products

The Highest Grade Wireless Equipment Made

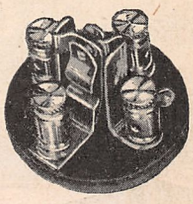
"IMPROVED" ANTI-CAPACITY JACKS



Closed circuit
Price 85 cents



Open circuit
Price 70 cents



Double circuit
Price $1.00

The first radical improvement and new departure in jack design and construction. Binding posts are well separated on all types. No soldering is necessary. Inductance is practically eliminated. Occupies much less space than the ordinary jack. Thoroughly protected by patent applications.

"IMPROVED" RADIO PLUG

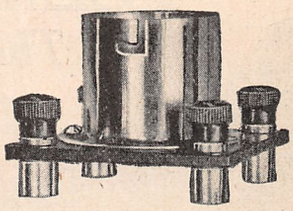
Price $1.75

Capable of universal attachment, whether there is a metal tip on the telephone cord wires or not. Designed by a highly skilled engineer, it does away with the necessity of tearing off the metal tips usually soldered to telephone cord wires. Accommodates tips of any size. Requires no screw driver or other tools to make connections. Fits all standard jacks. Operates as binding post where telephone cord is not provided with tip.

"IMPROVED" RADIO LAMP SOCKET

Price $1.00

This socket is of definitely superior design. Thumbscrews are provided for attaching wires quickly and easily. The socket is screwed firmly to the base, preventing trouble due to poor lamp contact. Base contacts cannot move sideways, as a locking tongue holds each securely in place.



The Organization Behind "Improved" Radio Products

"Improved" Radio apparatus and parts embody the finest design, workmanship, material and finish obtainable.

Our factories have been producing for years the finest grade precision instruments—the tachometer used during the war by the army and navy and as exclusive equipment on the N. C. flying boats which first crossed the Atlantic; electric motors for phonographs and high grade electric drills.

Our low retail prices are made possible by long experience and quantity production. Our parts have been adopted by leading manufacturers and distributors. If you want the best in Radio, superior products of original design and construction, place your order today. Immediate deliveries.

To the Trade

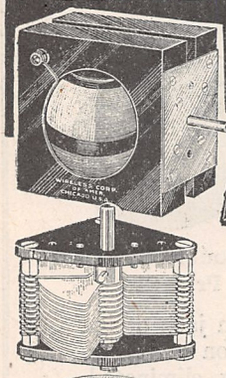
We have a definite sales policy, offering you protection and liberal profits on our products. A few territories are still open. Write, wire or call for full information.

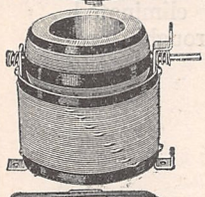
RADIO IMPROVEMENT CO.

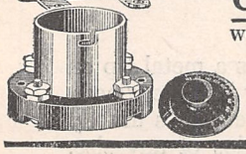
25 West 43rd Street, New York City

YOU CAN DEPEND UPON THESE RADIO PARTS

Guaranteed Perfect







Every part is made right here—in our own factory. Every part is inspected and tested by radio experts and pronounced perfect before shipping. Dependable receiving sets are made with parts we manufacture. Order direct from this ad. Satisfaction guaranteed or money back. Wiring diagrams and blue print—FREE.

Dealers - Jobbers Manufacturers

We have an unusually attractive proposition for you. Our radio supplies will increase your sales and make satisfied customers. Write For Particulars.

Price List

Variometers - -	$5.00
Vario Couplers - -	5.00
Transformers - -	5.00
23 Plate Condensers	3.60
43 Plate Condensers	4.50
Vacuum Tube Sockets	1.00
Crystal Detectors -	3.00
Dials and Knobs -	1.00
Grid Leaks - -	.60

OUR GUARANTEE Every part we make is guaranteed to perform the work for which it is intended or we refund money.

WIRELESS CORPORATION OF AMERICA
RANDOLPH ST. & OGDEN AVE., CHICAGO, ILL.

TELMACO

TELMACOPHONE

The Greatest Value on the Market

The BEST evidence of the merit of the **Telmacophone** is the enormous demand for this loud speaker. Inverted horn, reflected tone. Equal to any other horn twice its length. Designed and perfected by expert acousticians.

Complete in every detail. No extras to buy. Nothing to get out of order.

Do not be satisfied with an inferior substitute. Insist on the best for your money—the **Telmacophone.**

Price, Complete, $20.00, Fully Guaranteed

DEALERS: We are distributors for nearly all standard lines. Full discounts on the Telmacophone. Write for proposition on our complete line.

RADIO DIVISION
TELEPHONE MAINTENANCE CO.
20 So. Wells St. *Dept. B,* Chicago, Illinois

RADIO FOR THE NATION

Stores in five large cities enable this organization to supply radio equipment, both wholesale and retail, with the greatest speed and economy.

20th Century Radio Corporation
565 Fifth Avenue, New York City
Straus Bldg., Suite 710

Stores in Norwalk, Conn., Detroit, Mich., Newark, N. J., Brooklyn, N. Y., White Plains, N. Y.

CARDBOARD TUBING

Seamless—Grey	Per Inch or Fraction	Per Ft.
2½, 3 and 3½ in. O. D.	3½c	30c
4, 4½ and 4⅝ in. O. D.	4c	35c
5 in. Outside Diameter	4½c	42c
5½ and 6 in. O. D.	5c	50c

Postage Extra—Shipping Weight, 1 lb. per ft.

Dealers Write for Discounts

MICHIGAN RADIO CO.
2173 Hillger Ave. Detroit, Mich.

casting if certain variants between the low and high tones can be transmitted, which the microphone does not now receive accurately.

The transmitting room is equipped with three tubes of 50 watts each, an oscillator, amplifier and modulator. The instruments are enclosed in a roll-top desk. The antenna is 180′ long, with counterpoise over the roof of the building between 9th and 10th Streets. In addition to the broadcasting department, the store maintains a complete radio merchandising section where one may obtain advice from experts, and purchase receiving sets as well as a full line of parts of standard make. The section will soon be enlarged to include receivers of large type.

When we contemplate the vastness of the radio world, when we figure the stupendousness of the industry now and calculate vaguely what it will be one year hence, when we realize the untold possibilities of this latest art-science, then we may say truly that we are living in a marvelous age. The momentum of radio is grandiose in the strength and velocity of its movement. It bends all to its will. If it is to be harnessed and controlled, we must deal with it as with Niagara, carefully and cunningly in order to compel its application to our needs and to avoid being swept aside by its irresistible might.

Radio Digest

(*Contined from page* 451)

Last month the Department of Commerce authorized small additions to the radio equipment of several of its larger sea-going tenders to enable the crews to receive the radio broadcasting services for instruction and entertainment purposes, and consideration is now being given to making some similar use of the radio equipment placed on many of the lightships during the war, but not used since the Armistice, as well as on the principal outside lightships where a regular radio service is now maintained. These latter, such as Nantucket and Diamond Shoals lightships, are the outpost radio stations on our coasts, reporting incoming ships, forwarding messages, and sending word of vessels in distress.

With the cooperation of the Navy, radio telephones have recently been installed at several of the remote lighthouses in Alaska.

Some of the lightships are also equipped as radio fog-signal stations, with the new Department of Commerce system, used continuously during foggy weather to furnish accurate bearings to ships possessing the radio compass.

According to George R. Putnam, Commissioner of Lighthouses, radio should be a great boon in relieving the lonely and monotonous life of the faithful keepers at isolated stations both on lightships and at lighthouses. The keepers of the Alaska lighthouses at the entrance to Bering Sea remain at their posts for three years on a stretch; they have been without mail for ten months. At Tillamook Rock Light, off the Pacific coast, bad weather has prevented direct communication with the shore for periods of seven weeks at a time. On the offshore lightships supplies are received usually only once a month, and the tenders often work in remote localities. Relaxation at these stations depends chiefly upon libraries furnished by the government and donated magazines with an occasional phonograph presented by a thoughtful friend.

THE YOUNGEST "PROFESSOR" OF WIRELESS

Philadelphia has the youngest professor of wireless. He is William Noble Allen, 11 years old, a West Philadelphia boy, who has held a government radio license for more than two years. This is where the "professor" part comes in. He holds the chair of

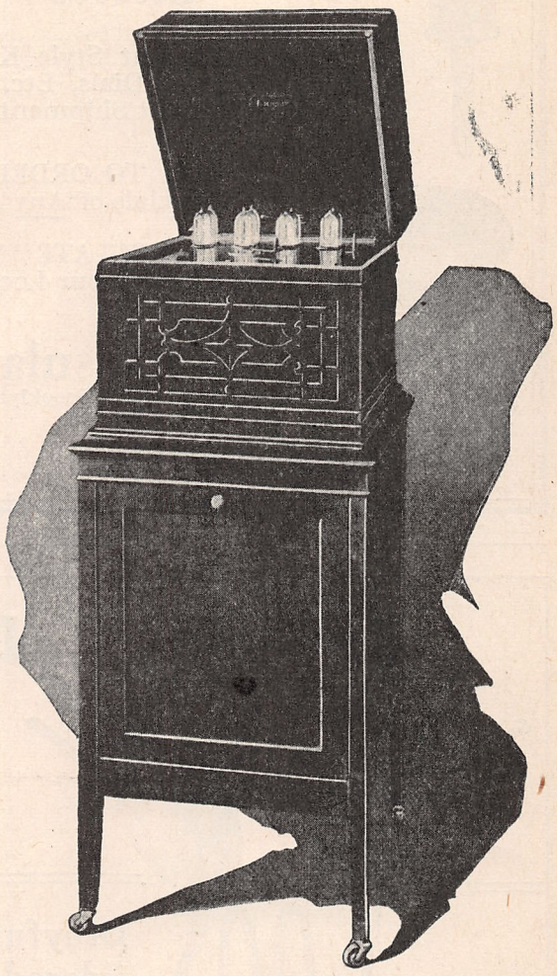
For this Broadcasting Receiver thousands have been waiting

EVER since broadcasting became the vogue there has been a demand for a receiver which would fill a whole room with music of perfect tone quality but which would be so simple that anyone could tune in by moving a single lever.

This ideal has at last been realized in the Aeriola Grand—the supreme achievement of present-day radio.

When you hear the voice and the music that come from the Aeriola Grand it is as if the lecturer or singer at the broadcasting station were in your presence. The whole family listens and marvels.

The Aeriola Grand stands unrivaled not only as a radio receiver but as a piece of cabinet work.



Prices

Complete with mahogany stand, storage battery, battery charger, antenna equipment and all accessories	$409.50
Without stand, storage battery, charger and receiving antenna equipment	$325.00
With stand, but without storage battery, charger and antenna.	$350.00
Mahogany stand only	$ 35.00

See the Aeriola Grand at your nearest dealer

Before you buy any receiver, secure a copy of the book "Radio Enters the Home." It tells the real story of radio and will help you to get the most out of this new art. 128 pages—over 200 illustrations—35c a copy. At your dealer or write direct to

What the guests heard at the Jacksons' Aeriola Grand Party

- Baseball scores
- Dance music
- Songs by a great ballad singer
- Lecture on the "Wedding Ring, Past and Present"
- A story by a famous author
- Chamber music by a noted string quartet
- The whole opera "Cavalleria Rusticana" with explanations
- News of the day

Weather forecast for the following day

Radio Corporation of America

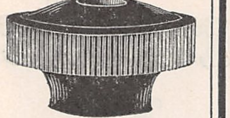
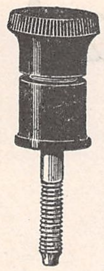
WORLD WIDE WIRELESS

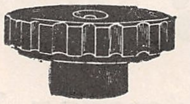
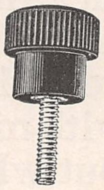
Sales Dept., Suite 2065
233 Broadway
New York, N. Y.

District Office
10 So. La Salle Street
Chicago, Ill.

"INSULATE"

MOULDED COMPOSITION

100 { Different Style Knobs, Binding Posts, Dials, Etc., in Stock for Prompt Shipment

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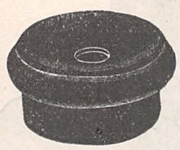
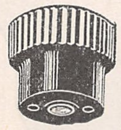
Specials of Any Article



Insist on "INSULATE" When Ordering Through Your Local Dealer



General Insulate Co.
999 Atlantic Ave., Brooklyn, N. Y.

AGENTS:
F. STEINBERGER........9 S. Clinton St., Chicago, Ill.
INSULATION MATERIALS CO........Cleveland, O.
HERRMANS-GRIFFITH CO........Sheldon Bldg., San Francisco, Cal.

DREYFUSS PHONES
(*Concert type*)

$8.00 Per Pair List Price

2000 OHMS

Dreyfuss Phones are considered the Best Phones for Radio Telephony work.

Designed by Telephony Engineers of over 18 years experience

Distributors:—Get in touch with us for open territories

We are NOW Making Delivery

P. M. DREYFUSS CO., Inc.
150-152 Chambers St. New York, N. Y.

RADIO DEALERS!
United Variable Condensers

A special contract with the manufacturer of the United Variable Condenser permits us to quote unusually low prices. Order from this ad—or if you are a dealer write for discounts today.

Base and top made of best quality bakelite, nickel-plated hardware, aluminum plates.

43 Plate (as cut)	$4.00
23 " (" ")	3.25
11 " (" ")	3.25

All sizes accurate in capacity

APEX RADIO COMPANY, Inc.
1105 W. 69th St., Chicago, Ill.

EVERYTHING IN

RADIO HARDWARE

FRANK WHEELER and SON
MERIDEN, CONN.

professor of radio in a public school, which numbers among its pupils many otherwise enlightened teachers who have tried to interest him in such worn-out subjects as geography, spelling and arithmetic.

Two years ago, at the age of 9, William passed the regulation government test for expert wireless operator with an average of 85 per cent. He was recognized by Uncle Sam as capable and fully qualified to send out the conventional S O S and other familiar code letters, and today he handles wireless messages at the rate of thirty words per minute, sending, and receives at the rate of twenty-five words a minute.

William lives at 4019 Baring Street. As he sat amidst the impedimenta of his professorship, he said: "My brother Arthur taught me all I know about this game. He is 19 years old, and has been wireless operator on five ships. Art was only 10 years old when he started to pick up wireless, and he started me in at 6. He certainly does know a lot about it.

"Yes, I've handled messages at a government wireless station," William continued. "Last summer mother and I went to Massachusetts, and the naval officers let me send messages from the Highland Light station on Cape Cod."

Some time ago the pupils were requested to prepare a paper on wireless. William's paper was so good and so comprehensive that the supervising principal, J. Wesley Foote, of the Belmont school, immediately arranged for the boy wireless wizard to deliver a series of lectures on his favorite topic. Now he does not teach to his own class alone, but to all of the classes in the school. They formed a Radio Club, and under William's direction the club erected an aerial on the roof of the school, and now the children are about to buy an expensive receiving set.

BUYERS ASK PERFORMANCE TESTS FOR RADIO RECEIVING SETS

Ever increasing public interest in radio has added to the troubles of department store buyers and others handling such equipment. Because of the rather technical problems involved, actual and prospective sellers of "ether wave" receiving devices say they are up against it in their efforts to satisfy the trade. Finding no information available to use in selecting good or rejecting bad apparatus and fearing the loss of established good will, appeals have been directed to the Bureau of Standards of the Department of Commerce to devise standard testing methods.

Performance test methods for immediate use by a commercial testing laboratory were recently agreed upon in an outline by representatives of the Bureau of Standards, the Electrical Testing laboratories of New York, and the National Retail Dry Goods Association. Suggestions regarding improvements on these methods, or new methods for testing the equipment submitted by the National Retail Dry Goods Association, will be subject to approval of the Bureau of Standards.

The tests outlined include examination as to the materials and workmanship of construction, the mechanical and electrical design, simplicity of adjustment, ruggedness, sensitivity, sharpness of tuning, wave length range, and faithfulness of reproduction in radio telephone reception.

The Investigating Committee of the National Retail Dry Goods Association has suggested that from a commercial standpoint it would be of assistance to their members if responsible manufacturers would plainly mark their equipment, indicating the receiving radius of each instrument under every atmospheric condition. Owing to the large number of factors which enter into the determination of the range over which signals can be received with a given set, this is a very difficult problem, impossible to overcome at present by a brief statement or mark. Strength of signals required by a receiving

RADIO APPARATUS

Distributors of Reliable Radio Apparatus to Schools, Colleges, Radio Clubs and Experimenters All Over the World!

"PITTSCO"

Specializing on "RADIO" CORPORATION'S Products

"PITTSCO"

Now has three Stores. Send us your orders.

The present tremendous demand for Radio Apparatus has practically made it impossible for us to render our usual SERVICE. Reasonably prompt delivery however can be made on the items listed.

AMPLIFYING TRANSFORMERS

No. P-1.	General Radio, semi-mounted	$5.00
No. 50.	Chelsea, semi-mounted	4.50
No. A-2.	Acme, semi-mounted	5.00

ANTENNA WIRE

"Pittsco" No. 14 hard drawn copper (80 ft. per lb.), per lb	.40
500 ft. (Special value)	2.25
"Pittsco" 7 strand No. 22 tinned copper, per ft	.01
500 ft	4.00
1,000 ft	7.50
"Pittsco" 7 strand No. 20 Phosphor bronze, per ft	.02
500 ft	7.50

ANTENNA INSULATORS

No. P-1.	Electrose ball insulator	.35
No. P-2.	Electrose 4 inch strain insulator	.45
No. P-3.	Electrose 10 inch strain insulator	.75

"A" BATTERIES (Storage Batteries)

Yale 6 volt, 60 Ampere-hour	18.00
Yale 6 volt, 80 Ampere-hour	21.00
Yale 6 volt, 100 Ampere-hour	25.00

Note.—These batteries are shipped carefully crated and fully charged ready for use.

"A" BATTERY RECTIFIERS

No. P-1.	Tungar, 5 ampere type, complete with bulb	28.00
No. P-2.	Tungar, 2 ampere type, complete with bulb	18.00
No. P-3.	F F Battery Booster, 5 ampere type	15.00

"B" BATTERIES

No. 763.	Eveready, 22.5 volt, small size	1.75
No. 766.	Eveready, 22.5 volt, large size, 16½ to 22½ volts	3.00
No. 774.	Eveready, 43 volt, large size, variable	5.00

CRYSTAL RECEIVING SETS

Aeriola, Jr., Westinghouse, complete with telephones	$25.00
Every-man's DeForest, complete with telephones	25.00

CONDENSERS (Variable)

No. 1.	Chelsea, fully mounted, .001 Mf	5.00
No. 2.	Chelsea, fully mounted, .0005 Mf	4.50
No. 3.	Chelsea, unmounted with dial .001 Mf	4.75
No. 4.	Chelsea, unmounted with dial .0005 Mf	4.25
No. 367.	Murdock, fully mounted, .001 Mf	4.50
No. 368.	Murdock, fully mounted, .0005 Mf	4.00
No. 3660.	Murdock, unmounted without knob and dial, .001 Mf	4.00
No. 3680.	Murdock, unmounted without knob and dial, .0005 Mf	3.25

JACKS (Radio Type)

No. P-1.	Open circuit	.70
No. P-2.	Closed circuit	.85
No. P-3.	Two circuit	1.00

LOUD SPEAKERS

Arkay, horn only, satin finish	5.00
Federal Pleiophone, complete with phone	14.00

PLUGS

No. 34-B.	Firco, round type	2.50
No. P-1.	Western Electric	1.10

SOCKETS

No. 156.	General Radio, improved model	1.50
No. P-1.	Chelsea	1.00
No. P-2.	Clapp-Eastham, bakelite type	1.00
No. UR-542.	Radio Corporati n	1.00

TELEPHONES

No. 56.	Murdock, 2,000 ohms	5.00
No. 56.	Murdock, 3,000 ohms	6.00
No. 2A.	Stromberg Carlson, 2,000 ohms	7.50
No. P-1.	Holtzer-Cabot, 2,200 ohms	8.00

Let "PITTSCO" fill your orders for any of the above items.

Our SERVICE on these at the present time will please you.

F. D. PITTS CO., Inc.

12 PARK SQUARE — **BOSTON, MASS., U. S. A.**

WOOLWORTH BUILDING, PROVIDENCE, R. I. — **3 STORES** — **276 WORTHINGTON STREET SPRINGFIELD, MASS.**

U.S. RADIO Co
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Insist on Getting THE BEST CRYSTALS ON THE MARKET

U. S. EAGLE GALENA, 25 Cents
U. S. EAGLE GOLDENA, 35 Cents

MOUNTED U. S. EAGLE GALENA AND GOLDENA, 2-in-1, 50 Cents

Patent Applied

Each U. S. Eagle Crystal is Packed with the following guarantee

GUARANTEE

We guarantee that each U. S. EAGLE crystal is tested and sensitive. If any U. S. EAGLE crystal is not satisfactory, return this slip with your address, and the address of your dealer direct to us, and receive another crystal free of charge by return mail. The U. S. EAGLE trademark is your protection.

U. S. RADIO OF PENNA., Inc.
Distributors of Domestic and Imported
Radio Telegraph and Telephone Apparatus
Cor. FERRY & DIAMOND STS., PITTSBURGH, PA.

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Address
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Attractive proposition for dealers and jobbers.
EVERYTHING IN RADIO SUPPLIES SEND 10 CENTS FOR CATALOGUE

U. S. RADIO CO. of PENNA., Inc.
Distributors and Manufacturers of Radio Apparatus
Corner of Ferry and Diamond Streets
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Everything in Stock at Retail---No Dealer or Jobber Can Clean Us Out

Complete Parts for a Short-Wave Regenerative Receiver

Chirad Variometer	$5.00
General Radio Condenser	3.25
2 Somerville 3¼" Dials	2.00
8 Somerville Insulated Posts	.60
8 Somerville Terminal Tags	.50
1 Condensite Panel, 16½x6⅝"	3.00
1 Federal Rheostat	1.00
1 Paragon Tube Socket	1.00
1 Grid-Leak Condenser	.40
1 .005 MFD Phone Condenser	.70
50 Ft. No. 14 Tinned Copper Wire	.25
32 Inch Length Spaghetti	.25
1 Quartered Oak Cabinet	7.50

Complete, with blueprint, $25.45

There is space in cabinet for the addition of amplifier later

ADDITIONAL EQUIPMENT

UV 200 Radiotron	$5.00
Somerville 22½ V. Battery	1.75
U S L 6 V. 60 A. Storage Battery	15.00
Stromberg Head Phones	7.50
Somerville Antenna Outfit, with Lightning Gap	3.25
	$32.50

OTHER SPECIALS

Bradley Stats	$1.85
Thordason Amplifying Transformers	4.50
Somerville 4" Dials	1.75
Somerville 3¼" Dials	1.00
Insulated Terminals	.08
Willard 84 V. "B" Battery	10.15
Brown Adjustable Phones	18.00
Voclarion Loud Speaker	6.50
Ducon Antenna Plug	1.50

SOMERVILLE RADIO STORES
MAIL ORDERS FILLED AT
43 CORNHILL BOSTON, MASS.

The RADIO-PHONE SALES CORP.
Announce
Long Range Receiving Sets
All Units in One Cabinet
TERMS TO DEALERS
Dept. 7-S, 308 S. Green St., CHICAGO, ILL.

GARSITE AN INCOMPARABLE CRYSTAL
—Each one tone tested and guaranteed—
Far superior to Galena, Silicon, Carborundum, etc. by actual scientific test
Special Rates to Dealers and Manufacturers on Quantity Lots
The Martin-Hewitt Laboratory
3199 BAINBRIDGE AVE. BRONX, NEW YORK CITY

operator, height and location of receiving antenna, power of transmitting station, its location with respect to other stations capable of causing interference as well as the sensitivity of the particular receiving set, must all be considered, according to Bureau of Standards experts.

The 20 KW Power Tube

(*Continued from page* 442)

telephone outfit, used for broadcasting, generates from ½ to 5 kw kilowatts of high frequency power, which is used to feed the antenna.

The design and construction of tubes of this type have been carried out principally by Mr. W. C. White.

It has long been realized that, following out the principles made use of in the smaller tubes, it would ultimately be possible to construct tubes of larger power. There have been many difficulties to overcome, however. After years of work by Mr. W. C. White and Mr. E. J. Nolte, they have succeeded in designing and perfecting pliotrons which are capable of generating about 20 kw. of high frequency current.

The 20 kw. tube has a very large, rugged filament, many times the diameter and length of the ordinary radiotron. The grid is in cylindrical form and surrounds the filament, and the plate is a metallic cylinder about 1½ inches in diameter and 8 inches long, which is sealed directly to a glass tube through which pass the leads carrying current to the filament and grid.

Thus the plate, instead of being inside of the tube, as in ordinary radiotrons, forms a part of the outside wall of the tube. In order to dissipate the relatively large amount of energy liberated at the plate, the plate is water cooled, which is rendered particularly easy by the fact that part of its surface forms a part of the wall of the tube.

These 20 kw. tubes are ordinarily operated with about 20,000 volts d.c., which is obtained from ordinary 60 cycle alternating current by rectification, using two or more kenotrons, together with large condensers for smoothing out the rectified alternating current.

A bank of ten tubes of this kind operated in parallel is capable of generating 200 kw. of power, which is about all that is required for most transoceanic radio communication It is probable that outfits of this kind will displace the larger and more expensive alternators, the most successful type of which has been the Alexanderson alternator.

The 20 kw. tube merely marks one stage in the development of still larger tubes. It will undoubtedly be possible, when the need arises and when the necessary development work has been completed, to construct tubes of many hundreds, or even thousands, of kilowatts. Such devices will probably be used not merely for radio purposes, but may ultimately play an important part in such problems as the electrification of railroads and the transmission of power to long distances by means of direct current.

SOUNDING THE DEEP

The *Destroyer Stewart*, equipped with the Sonic Range Finder, used for sounding at sea, has made a practical test trip from Newport to Gibraltar. The new method is closely related to radio, depending on the transmission of sound waves through water, and is employed to measure depths of the ocean. Soundings are made by measuring the length of time required for sound oscillations sent out from the ship to travel to the bottom of the ocean and back again. Dr. Harvey C. Hayes of the Naval Engineering Technical Staff, who aided in the development of the new naval equipment, is making the trip on the *Stewart*.

Daily reports from the destroyer, during her trip across the Atlantic, indicate that the

Your Choice

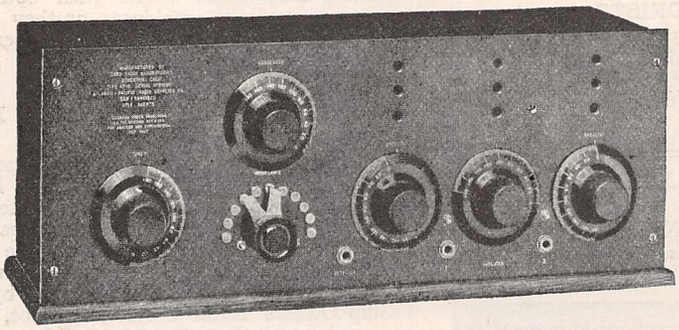
"Your final choice—why not your first?"

A-P

"CHOICE" APPARATUS

A-P is one of the oldest trade terms in radio, and universally recognized as symbolizing excellence, performance and quality. A-P Apparatus will be *your final choice—why not* make it *your first?* The A-P Apparatus listed below is designed particularly for receiving radio concerts and other broadcasted features in the home, and to present an attractive appearance that will make it welcome in any surroundings. It enables any home to be radio equipped with dependable apparatus of known value at moderate cost. Without sacrificing its radio efficiency, it has been made simple and easy to operate so that splendid results should be secured from the start. For further information write us for folder, mentioning the name of your radio dealer if possible.

Type AR-2 Receiver Detector and two-stage Amplifier, $135



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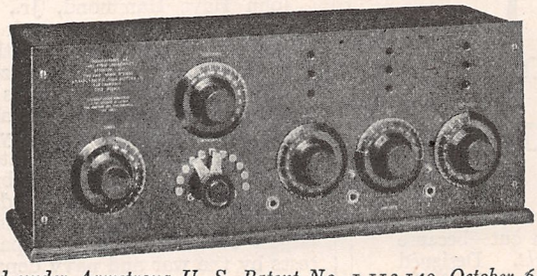
Type DR-5 Receiver and Detector, $85



Licensed under Armstrong U. S. Patent No. 1,113,149, October 6, 1914, for amateur and experimental use only.

Type AR-2 Set combines in a single beautiful cabinet a Receiver, Detector, and two-stage Audio Frequency Amplifier. The famous Armstrong Regenerative Circuit is incorporated in the set in such way as to enable broadcasted features to be received loud and clear over long distances. The Audio Frequency Amplifier, designed to give maximum amplification without distortion, enables the set to be used with a Magnavox or other loud speaker to secure large volume. Every detail of typical A-P quality. Particularly noteworthy are the solid mahogany cabinet with a beautiful light walnut finish, and genuine Bakelite Dilecto panel. Wave length range, 175 to 1600 meters. A neat, compact and efficient home set, quickly installed and easily operated. Blue print of circuit and instruction card with each set. Price **$135,** f. o. b. San Francisco.

Type DR-5 Receiver. The same Receiver incorporated in Type AR-2 set described above, but built in a beautiful mahogany cabinet by itself without the Audio Frequency Amplifier. Highest grade parts throughout, insuring quality and performance. Terminals in the rear to prevent unsightly wires spoiling appearance of front panel. Oscillates and regenerates freely and easily over its entire range of 175 to 1600 meters. All inductances of special Pyramid windings. Instruction card with each set. Price **$85,** f. o. b. San Francisco.

MANUFACTURED BY OARD RADIO LABORATORIES—STOCKTON, CALIFORNIA
ATLANTIC-PACIFIC RADIO SUPPLIES CO.—SAN FRANCISCO—Sole Distributors

AP-4 Radio Receiver and AP-3 two-stage Amplifier

The AP-4 Radio Receiver, designed for home reception of broadcasted service within a radius of 100 miles. Within this radius it will give equally as good results as more elaborate apparatus, and under favorable conditions this radius should be doubled. Wave length range, 175 to 500 meters. Cabinet made of highly polished gumwood. Genuine Bakelite panel and dials. Price **$45,** f. o. b. San Francisco.

AP-3 two-stage Amplifier, particularly designed and adapted for use with AP-4 Radio Receiver to furnish amplification for reproducing concerts and other broadcasted features in volume. Furnishes two stages of amplification free from noise and distortion. Matches AP-4 in specifications and appearance. Cabinet of highly polished gumwood. Genuine Bakelite panel and dials. Price **$50,** f. o. b. San Francisco.

Atlantic-Pacific Radio Supplies Co.

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Dealers and jobbers invited to write us

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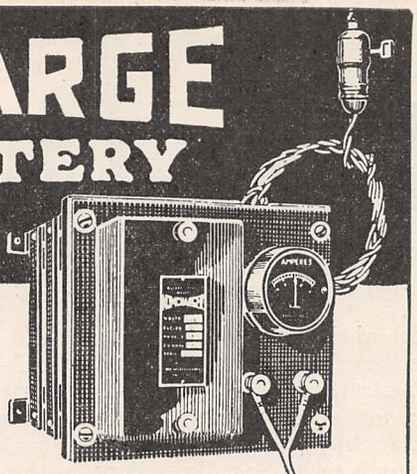

No muss, trouble, dirt—no moving of batteries—loss of time—no effort on your part—no technical or professional knowledge needed.

THE **HOMCHARGER**

successfully meets all charging conditions, and is the only rectifier combining the following essential Homcharging features.

1. Self-polarizing. Connect battery either way and it will always charge. No danger of reverse charging, ruined battery or burnt-out rectifier.
2. No delicate bulbs to break or burn out. Only one moving and two wearing parts. These are replaceable as a unit, after thousands of hours' use, at small cost. Cannot be injured by rough handling.
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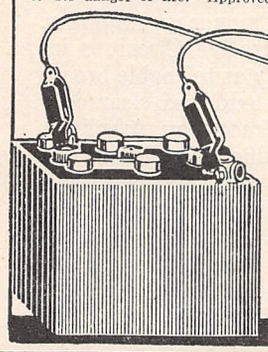
4. The only charger costing less than $100.00 that will fully charge a battery over night. Gives battery a taper charge—exactly as recommended by battery manufacturers. Guaranteed not to harm your battery even though left connected indefinitely.
5. Highest efficiency of any three or six cell charger made.
6. No danger of fire. Approved by the Underwriters.



ATTENTION MOTORISTS

Will charge your auto battery as well as radio battery. Send for Bulletin No. 58 for further information. For sale by all radio, electrical and accessory dealers or shipped, express prepaid, for purchase price $18.50

$20 West of the Rockies

THE AUTOMATIC ELECTRICAL DEVICES CO.

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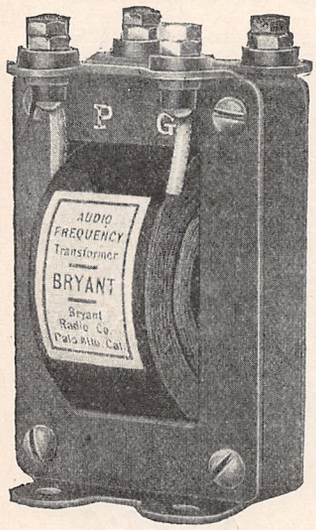
BRANCH OFFICES—New York, Chicago, Pittsburgh, Los Angeles, New Orleans, Detroit, Philadelphia, Baltimore, Dallas.

Wherever volume is desired, use—



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"The Transformer that won't burn out"

If you want volume you want a *Bryant* Amplifying Transformer. *Bryants* won't burn out—because they are *designed right* and *made right.* Designed by the radio engineer who designed nearly all the navy amplifiers now in service, every one made to measure up fully and exactly to his specifications. Only Bryant makes them, but anyone can use them. Equally efficient in amplifying radio music, radio speech, or radio signals. The best transformer money can buy at any price, yet priced as low as any. Beautiful, efficient, durable. Both windings of heavy wire—ratio 3½ to 1. Sold by dealers. If your dealer hasn't *Bryants*, order from us. Price $5

Money-back GUARANTEE

We unconditionally guarantee every *Bryant* Amplifying Transformer to give you a long life of satisfactory service. We will gladly refund the purchase price on any transformer we manufacture which is not completely satisfactory in every way in actual operation.

Bryant Radio Co., Mfrs.

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apparatus was a great success. Soundings were taken at regular intervals without stopping the ship, and indicated depths from 90 to 2,500 fathoms. These soundings correspond to those taken by the old laborious method with the wire and lead, which required the stopping of the ship for one or two hours during the operation.

VETERANS' BUREAU BROADCASTS WANT ADS

By means of the Navy's radio broadcasting station at Anacostia, NOF, the Veterans' Bureau Employment Service is broadcasting to veteran radio fans opportunities for employment, and is also broadcasting the names, for the benefit of prospective employers, of "Vets" skilled in various trades and professions who are in search of employment.

The first "Radio Want Ads" went out last week and several replies have been received; two men, at least, are now in direct touch with prospective employers.

The broadcasting is a part of the Bureau's plan to establish national and departmental clearing houses for social, industrial and professional employment. Officials of the Bureau believe that with the radio they are getting into closer touch with both the veterans and the employers, as they reach the family circle in an even more personal way than through the newspapers.

INCREASE IN RATE OF RADIO MESSAGES

Forty-four ship radio stations, operated and controlled by the Ship Owners' Radio Service, increased the ship message rate from 4 cents to 8 cents per word for all classes of ship service, beginning July 1st. The radio ship stations owned by the Alaska Steamship Company, which are also operated by the Ship Owners' Radio Service, will not, however, increase the present rate of 4 cents per word.

SECRET RADIOPHONE COMMUNICATION POSSIBLE

John Hays Hammond, Jr., who has for years stood in the front rank of American radio engineers, may be the father of a great invention which will revolutionize radio broadcasting, if successful tests of his latest invention are followed by its practical application.

He has worked for fourteen years on a device to permit secret or private radio communication. And the official bulletin issued by his offices states that, in a demonstration of his model given before officials of one of the largest American radio companies, and in tests by the war and navy departments, the system has proven absolutely practical.

It is said to have these advantages:

It affords a private means of communication, since no other stations, unless specially equipped, can pick up the messages.

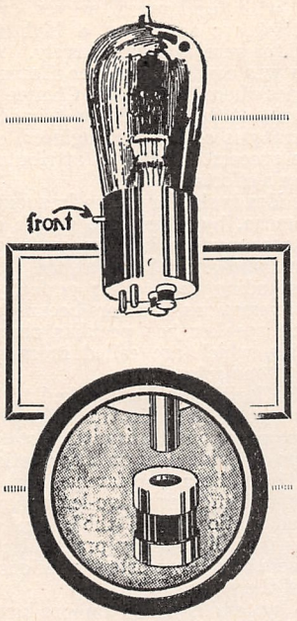
It will allow a far greater number of stations to communicate over a limited number of wave-lengths.

Accidental interference from other stations will be greatly reduced.

The effect of static is diminished to such an extent that the system is operable under conditions in which the ordinary apparatus cannot receive.

The system embodies a direct means of insuring privacy, his research indicates, and it will be practically impossible, under ordinary conditions, for any other than the proper receiving station to receive anything more than a jumble of sounds which will not be translatable. It is expected to transmit both code and voice, over the same set, in such a manner that several code messages and phone conversations may be carried on at the same time.

No changes are made in radiating or receiving aerials, and the present vacuum tube receiving sets can be used. It is no maze of technical detail and contrivances, but a well designed scientific instrument which is most efficient and at the same time economically



Capacities ½, ¾, 1, 1½, amps.

Among "things that never happen"

or, so far as that is concerned, things that *cannot* happen, is the "burning out" from any excessive amperage whatever, even an accidental short, of the filament in any vacuum tube protected by the

RADECO SAFETY FUSE

(PAT. PENDING)

for VACUUM TUBES, METERS and other DELICATE INSTRUMENTS

Attached in a jiffy, with no trouble at all, this midget fuse gives absolute protection to the filament under all conditions and lengthens the life of the tube indefinitely. It fits any standard bulb used in any standard socket and positively does not affect the efficiency of your set.

At this particular time when bulbs are hard to get, the Radeco Safety Fuse not only saves many times its cost but insures continued operation of your set.

Come only in packages of four **4 for $1** *Order by mail or from your dealer*

We can make immediate delivery on sizes for the following tubes: Electron Relay, A-P Amplifying Tube, Double Filament Audiotron, Cunningham C-300 and C-301, Radio Corp. UV-200 and 201.

When ordering, specify what tube you want fuses for

Special CRYSTAL DETECTOR RECEIVERS

Biggest Value on the Market!

Complete with Variable Condenser, Vario-coupler, Tapped Primary, Buzzer Test, Cord Tipped Jacks for Phones, Bakelite Panel and Grade A Crystal. **$20**

TYPE HR CLAPP-EASTHAM REGENERATIVE RECEIVERS

The most popular tube set made for amateur use. Compact, efficient range up to 1500 meters.

In Mahogany Case $40

2-Stage Amplifier to Match $40

LIGHTNING SWITCHES 600-V 100 amp. (regular $5 switch) - $2.25

45V VARIABLE UNIT "B" BATTERIES - $3.60

With phosphor bronze jiffy connectors

KEYSTONE ARRESTERS - - $1.75

CARBON RHEOSTATS - - - $1.50
(ADJUSTING TO .01 AMP.)

USL STORAGE BATTERIES - $15.00
(6V 60-80 HOUR)

HOLTZER-CABOT PHONES - $8.00 Pr.
(2200 OHMS)

We carry a complete stock of parts and sets at standard prices. Order from any standard catalog

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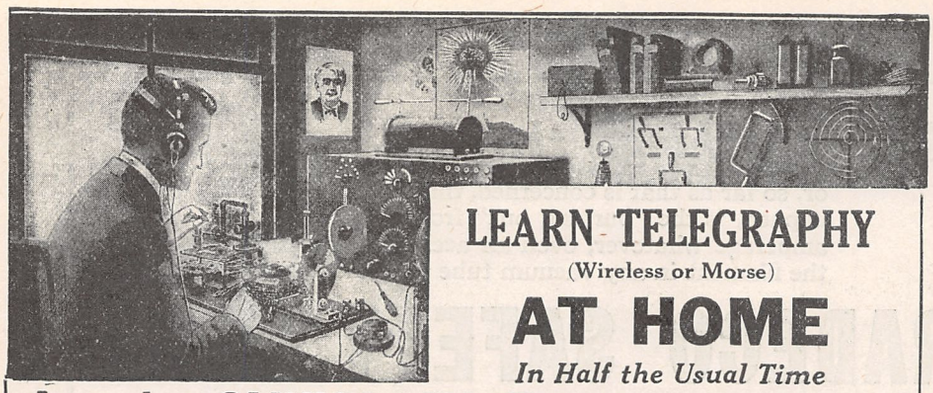
New England's Oldest Exclusive Radio House

We Carry Only the Best Radio Goods



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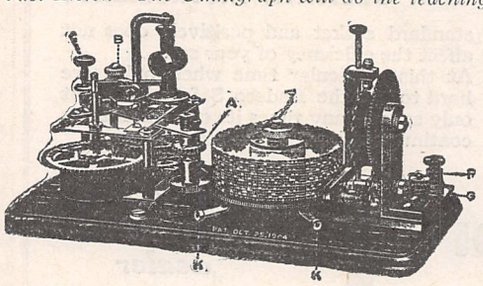
In Half the Usual Time

Let the OMNIGRAPH Teach You Wireless

"Just Listen—The Omnigraph will do the teaching" The Omnigraph is an *Automatic* Transmitter that teaches you both the Wireless and Morse Codes, at home, without any expense except the cost of the machine itself. Merely connect to battery and your Buzzer, or Buzzer and Head Phones, or to your Sounder, and the Omnigraph will send unlimited messages by the hour, *at any speed* you desire.



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Write for Free Catalogue

For a few dollars you can have a complete outfit that will make you an experienced operator in the shortest possible time. No hard, laborious work—just learn by listening. The Omnigraph is adjustable so you can start receiving messages slowly, gradually increasing the speed as you become proficient.

You'll be surprised how quickly you will attain speed. Even if you are already an operator the Omnigraph will help you. It will make you more proficient, more accurate and more confident. Thousands of Omnigraphs are in use today and thousands of operators owe their success to them.

The Omnigraph Mfg. Co., 20 Hudson St., New York City

Mr. Maker of Radio Apparatus Try

NATIONAL SEAMLESS TUBING in Large Diameters

For Vario-couplers, Variometers, Tuning Coils and wherever you use large diameter fibre tubing, this tubing is less expensive and infinitely superior.

It is a fibre tube built especially for radio work. Will not warp, shrink or swell. Exact dimensions, high dielectric. Sizes from 3″ to 4½″ ID, any thickness of wall from 3/32″ up. Comes in Dark Gray, Black, or dipped in insulating varnish. *Samples and prices on request.*

Use National Fibre for Panels

Hard, black stock, for condenser tops and bottoms, rheostat bases, bushings, etc. Let us quote on the stock, or completed parts machined to order.

Ask for Peerless Insulation

The Standard thin weight fibre or "fish paper."

NATIONAL FIBRE & INSULATION CO.

BOX 471 -:- -:- -:- YORKLYN, DELAWARE

For Reliable Broadcast Reception Use a

"Cramer Radio Broadcast Receiver"

Handsome in appearance; simple in control; highly efficient in operation, it receives concerts with remarkable clarity. Fulfills every desire of those who are particularly exacting in their requirements. Price, without receivers, batteries and tube, only $35. Prompt shipment.

Order one today or send for circular

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Newark Wireless Exchange

We carry all makes of Wireless Apparatus

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Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year. Experimenter Publishing Co., 53 Park Place, N. Y. C.

practical in the commercial world, Mr. Hammond says.

Mr. Hammond made his first experiments in the new device with damped waves, and later with undamped waves, where an oscillating arc and then a high frequency alternator were used successively. All the research was conducted in the Hammond laboratories where Dr. E. Leon Chaffee, professor of physics at the Cruft laboratory of Harvard University is consulting engineer, and much of the success attained is attributed to Dr. Chaffee's efforts.

The idea is similar to the frequent acoustic phenomena, by which two people can carry on a conversation in a room full of other persons who are talking at the same time, understanding each other perfectly despite the conversations of others because the voice of each speaker has peculiar characteristic qualities, which are called in musical parlance, "tone color."

Radio legislation has worked to eliminate all tone color in radio transmission, and to produce pure tone transmitting stations that have no individuality or characteristic quality. The radio art so far has devoted itself to use of different wave-lengths, to differ between stations, and the range of wave-lengths is so limited by practical conditions that there is to-day existent a serious "crowding" of the ether.

The system is based on production of a characteristic type of wave to which only specially prepared receivers are receptive, and has accomplished the result, insofar that a number of these stations can send and receive different messages while operating on the same wave-length. Thus it brings into radio a new selective feature which is entirely removed from present methods of achieving selectivity, and which will allow a far greater number of stations to operate through the ether at the same time, thus overcoming a serious problem which now faces all radio communication.

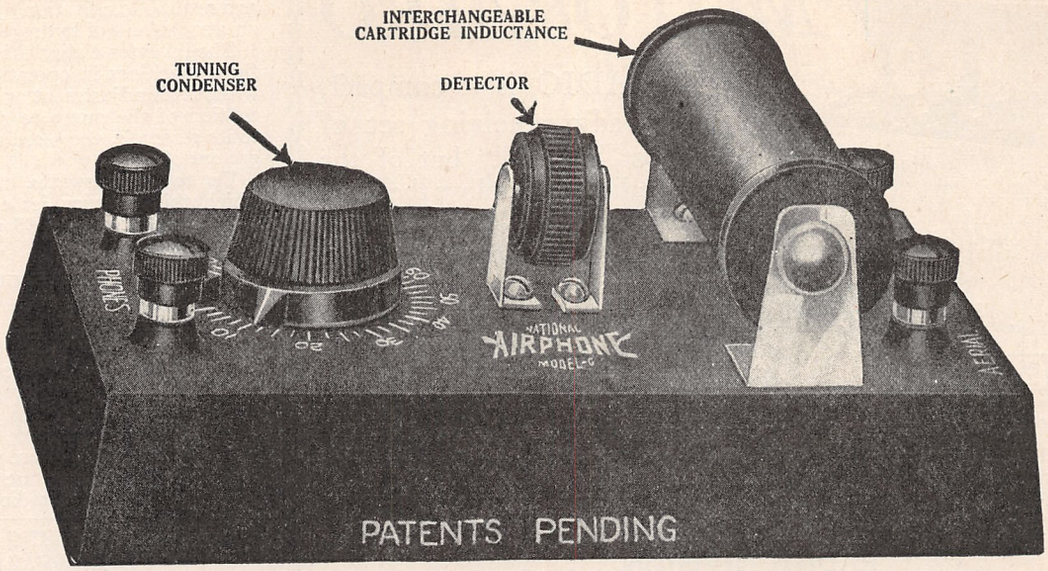
Mr. Hammond believes that by the use of his apparatus the space about us may be made to hold open almost any infinite number of channels, as telephone and telegraph wires do now. Not only is it applicable to private communication between two stations, he says; it is possible also to have several code messages and several telephone messages travel simultaneously from one station to another. It is much similar to the system of carrier current telephony, and offers great possibilities for application to news service, commercial radio and all the other manifold fields of the art.

NEW ELECTRIC CONVERTER DEMONSTRATED

An ingenious device for converting alternating to direct electric current by means of a jet or stream of mercury is now being demonstrated at Columbia University by Dr. Julius Hartmann, of Copenhagen. This invention, experts think, may supplant the mercury arc rectifier for use in battery-charging sets. Some experts also see the possibility of this new apparatus replacing the extensive converter now used in furnishing power to street cars.

In this new method the alternating or pulsating current flows through a jet of mercury which passes between the poles of a permanent or constant electro-magnet. The magnetic force acting on the jet changes its direction with the changing direction of the alternating current and the stream of mercury swings from side to side like a stream of water from a garden hose swung in the hand.

As the jet swings backward and forward, it passes from one to the other of two electrodes separated by an insulating quartz wedge. One of these is connected to the positive side and one to the negative side of the direct current apparatus. By properly adjusting the distance of these electrodes from the magnet the swinging of the jet is so timed that it strikes the positive electrode only when the current is positive and the negative only when the current is negative, thus rectifying the alternating current.



Price $12.50

(Without Phones)

NATIONAL AIRPHONE

(MODEL G)

A New Radiophone Easily Operated by a Child Practical for the Office and Home

To operate simply connect aerial, ground and head-phones. Will receive radio broadcast entertainments and commercial reports within a radius of 25 miles; Code signals 1000 miles and over depending upon coils used.

Outstanding Points of Superiority:

1. Most Compact Radiophone Receiving Set Made: 6½" long, 4¼" wide, 2¾" high—small enough to put in coat pocket or desk drawer.

2. Rugged construction throughout, nothing to get out of order, insuring long life in service.

3. Entire casing constructed of hard rubber composition. No wood, no warping, no losses through leakage.

4. Ultra-sensitive Foolproof Detector; entirely enclosed in composition case. Air and dustproof, no fussy minerals, no Catwhisker, no balls nor spring. To adjust for maximum sensitivity simply rotate the black disk slowly.

5. Elimination of all switches, current taps and switchpoints prevents loss of electrical energy.

6. Use of interchangeable cartridge coils gives wide range over which radiophone broadcast or radio telegraph signals can be heard. 25 miles or over for radiophone concerts; up to 1000 miles for telegraph signals depending upon coils used.

7. Two Cartridge tuners, wave length 150 to 400 meters, supplied with each outfit; one takes in general broadcasting stations (360 meters), the other from 500 to 1000 meters.

8. Variable Mica Condenser used is acme of simplicity—high capacity, impossible to short-circuit.

9. Anyone without previous experience can operate a NATIONAL AIRPHONE, no delicate adjustments necessary, no fussing.

TRADE MARK NATIONAL AIRPHONE CORPORATION REG. U.S. PAT. OFF.

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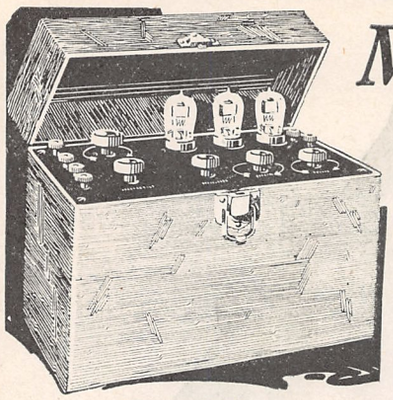


MOTORADIO

MOTORADIO is a compact, portable radio receiving set of the utmost simplicity but of the highest quality. It employs the Armstrong regenerative circuit having fixed antenna condenser of two different values and variometer for tuning Two stage audio frequency amplifier, having jack for detector and for second stage of amplification. Range 150 to 600 meters.

Ideal for automobile or home use. *We believe this to be the best mechanically constructed and finished set on the market.*

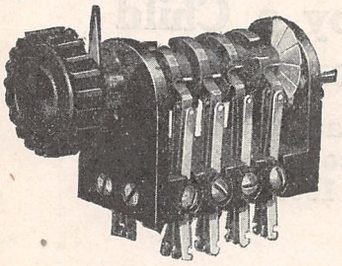
Attractive discounts to dealers. Immediate delivery.

RADIO DIVISION

Earle C. Anthony, Inc.

820 West Seventh Street Los Angeles, California

ARKAY UNIVERSAL CAM SWITCH



Gives Absolute Control Of Any Amplifier

THE ARKAY SWITCH takes the place of jacks and plugs in amplifier circuits. Its rotary action gives instant change-over from detector to amplifier or succeeding changes of amplification, at the same time providing filament control.

THE ARKAY SWITCH can be used as a send-receive switch or a short and long wave change switch, in fact for any switching necessity, by merely shifting the position of the cams on the shaft.

PRICE **$5**

There is no switch on the market superior to the ARKAY. It is built of highest grade condensite; contacts of sterling silver, set in nickel silver springs. Superior workmanship throughout—and backed by the Arkay guarantee.

Manufacturers, Jobbers and Dealers Will Be Given Liberal Discounts

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THE Wabash CABINET CO.

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QUALITY CABINETS

Radio Manufacturers who require plain or fancy cabinet work of quality will find it to their advantage to send us their plans and specifications for quotations.

THE WABASH CABINET CO.

WABASH - - - INDIANA

The spent mercury is continuously pumped back to the reservoir which feeds the jet and is prevented from becoming dirty or fouling as a result of oxidization by passing it through an atmosphere of hydrogen or coal gas.

The inventor claims that he has had one of these machines in operation for over a year without an adjustment and that with the exception of the pump to return the mercury to its reservoir, there are no moving parts to get out of order.

Up to 50 kilowatts, the largest size in which this mercury jet converter has been built, an efficiency of 95 per cent. has been obtained.

ILLUSTRATED LECTURES BY RADIO

The first illustrated lecture by radio was delivered recently from broadcasting station WFO at Dayton, O., by Ralph Hayes Hamilton, of Xenia, O. While he talked into the microphone, colored pictures were projected in the studio. Duplicate sets in other cities were arranged in the same order, so that they were shown as the lecture was being received by radio. In the picture Hamilton is seen giving his illustrated radio lecture.

ENGLAND LOOKING TO AMERICA FOR APPARATUS

That England is looking to America for part of her radiophone apparatus and equipment is indicated by recent queries as to sources of supply for radio equipment filed with the Department of Commerce.

General Resolutions Adopted by the Radio Telephony Conference

Resolved that the Conference on Radio Telephony recommend that the radio laws be amended so as to give the Secretary of Commerce adequate legal authority for the effective control of:

(1) The *establishment* of all radio-transmitting stations except amateur, experimental and Government stations.

(2) The *operation* of non-Governmental radio-transmitting stations.*

Resolved, that it is the sense of the Conference that radio communication is a public utility and as such should be regulated and controlled by the Federal Government in the public interest.

Resolved, that the types of radio apparatus most effective in reducing interference should be made freely available to the public without restriction.

1. ALLOCATION OF WAVE BANDS FOR RADIO TELEPHONY

A. It is recommended that waves for radio telephony be assigned in bands, according to the class of service, as given in the following table.

Throughout this report both wave lengths and wave frequency are given. Wave length in meters is 300,000,000, divided by wave frequency in kilocycles per second.

Wave bands marked *exclusive* can be used for no other type of service; those marked *non-exclusive* are available for other types of radio communication, subject to regulation.

Use	Wave Length Meters	Wave Frequency Kilocycles, per sec.
(1) Transoceanic radio telephone experiments.	6,000	50.
non-exclusive. (See Note 3)	5,000	60.
(2) Fixed service radio telephony, non-exclusive.	3,300	90.9
(See Note 4)	2,850	105.2
(3) Mobile service radio telephony, non-exclusive	2,650	113.2
	2,500	120.
(4) Government broadcasting, non-exclusive. (See Note 1)	2,050	146.
	1,850	162.

**It was the desire of the Conference that the present authority of the Secretary of Commerce over the operation of radio-transmitting stations be extended and that the Secretary of Commerce be granted authority to control the erection or establishment of certain classes of radio stations.*

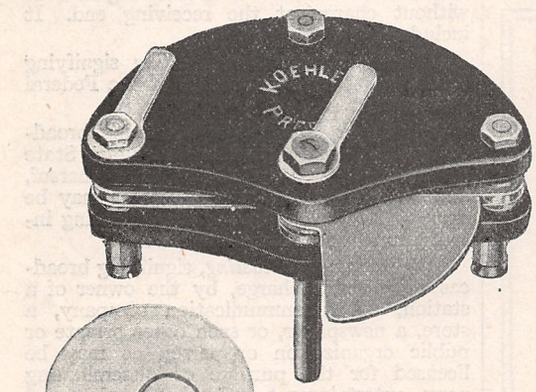
PREPARE!

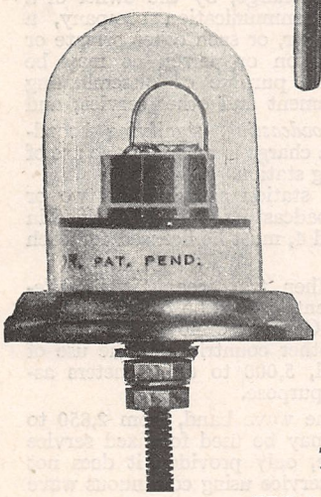
To Make Big Money

This Fall and Christmas

RADIO business is going to be larger and more profitable this fall than ever before. New developments will open up a vast potential market and sharpen the interests of all radio fans. The Christmas trade will be tremendous.

How much of this business you will get depends a good deal upon how **far-sighted** you are. Remember the hectic months of the first wave of radio popularity and be ready this time with complete stocks. Don't wait till the last minute. Map out your policy, plan your operations and **place your order NOW!** The services of the Wholesale Radio Equipment Co. will help you do the best possible business. Whatever your need, we have plenty always in stock—products of 16 or more of the most important nationally known manufacturers. Deliveries to meet every situation. Let's get together NOW.





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Two Very Profitable SPECIALS

Koehler 3-Plate Vernier Variable Condensers

Heavy aluminum plates, thick Bakelite ends, other parts of brass, nickel plated. .000075 MFD capacity. Other sizes. Accurately manufactured and carefully tested. Koehler Condensers have made good.

LIST **$1.50**

GREWOL Crystal Detectors

No trouble selling this fixed detector. Stays adjusted. Guaranteed tested crystal in dust-proof glass cup.

LIST **$2.00**

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Western Electric

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Test Our Service With a Trial Order of These Two Standard Sellers

Write for Attractive Discounts on Our Complete Line

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MEMORIZE CODE IN ONE HOUR

BKUMA YRLSBUG
Trade Mark

Double the Pleasure and Efficiency of Your Radio Set!

Don't be content with broadcasted concerts only; understand the ship and commercial station messages that are going thru the air all the time.

Knowledge of the Code has given added pleasure to thousands of radio enthusiasts.

THE DODGE SHORT CUT METHOD teaches you the Wireless Code easily, quickly, accurately—many learn in less than one hour with our system. Honor roll sent upon receipt of four cents in stamps.

SEND ONE DOLLAR *for*
COMPLETE COURSE

C. K. DODGE BOX 200 MAMARONECK, N. Y.

DEALERS! DEALERS!

We Are Distributors of

DEFOREST RADIO SETS and EQUIPMENT

WESTERN ELECTRIC LOUDTALKER and HEADSETS

STROMBERG-CARLSON HEADSETS, PLUGS and JACKS

and

"EVERYTHING IN RADIO"

The North American Radio & Supply Corp.

5 COLUMBUS CIRCLE *Formerly Aldan Accessory Co.* NEW YORK, N. Y.

TEAR OFF AND ATTACH TO LETTERHEAD

North American Radio & Supply Corp.
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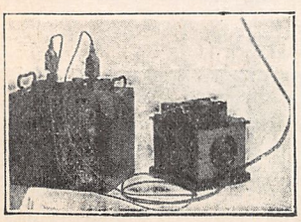
Kindly send us your New Catalog of Radio Sets and Equipment.

Firm Name.....

Street ..... City.....

Charge Your Radio Battery With a Union Rectifier



Get a Union Rectifier to charge your radio battery and your station will operate at maximum efficiency. Connect rectifier plug to 110 volt lighting socket and connect clips to battery and turn on current at socket and your battery will charge at the proper rate with taper charge. Operates automatically and will last for years.

Rectifier complete for charging 6 volt battery... **$15.00**

New descriptive bulletins on request.

Order one of these rectifiers today and keep your batteries charged.
DEALERS WANTED EVERYWHERE
UNION RECTIFIER COMPANY, Monroe, N. C.

Wholesale **RADIO** *Retail*

COMPLETE STOCK. PROMPT SERVICE.
SPECIAL DISCOUNT TO DEALERS.
SEND FOR OUR CATALOG AND SAVE TIME AND MONEY.

CHICAGO ELECTRICAL SUPPLY COMPANY

360 West Madison St. Chicago, Illinois

(5) Fixed station radio telephony, non-exclusive. (See Note 5)	1,650 1,550	181.8 193.5
(6) Aircraft radio telephony and telegraphy, exclusive	1,550 1,500	193.5 200.
(7) Government and public broadcasting, non-exclusive	1,500 1,050	200. 285.7
(8) Radio beacons, exclusive. (See Note 6)	1,050 950	285.7 316.
(9) Aircraft radio telephony and telegraphy, exclusive	950 850	316 353
(10) Radio compass service, exclusive. (See Note 7)	850 750	353 400
(11) Government and public broadcasting, 200 miles or more from the seacoast, exclusive	750 700	400 428
(12) Government and public broadcasting, 400 miles or more from the seacoast, exclusive	700 650	428 462
(13) Marine radio telephony, non-exclusive. (See Note 8)	750 650	400 462
(14) Aircraft radio telephony and telegraphy, exclusive. (See Note 8)	525 500	572 600
(15) Government and public broadcasting, exclusive	495 485	606 618
(16) Private and toll broadcasting. (See Note 9).	485 285	618 1,052
(17) Restricted special amateur radio telegraphy, non-exclusive. (See Note 10)	310	968
(18) City and state public safety broadcasting, exclusive. (See Note 11).	285 275	1,052 1,091
(19) Technical and training schools (shared with amateur). (See Note 12)	275 200	1,091 1,500
(20) Amateur telegraphy and telephony (exclusive, 150 to 200 meters). (Shared with technical and training schools, 200 to 275 meters). (See Note 13)	275 150	1,091 2,000
(21) Private and toll broadcasting, exclusive	150 100	2,000 3,000
(22) Reserved.....below	100	above 3,000

NOTE 1.—The terms used in the above schedule are defined as follows: "BROADCASTING" signifies transmission intended for an unlimited number of receiving stations without charge at the receiving end. It includes:

(1) *Government broadcasting* signifying broadcasting by departments of the Federal Government.

(2) *Public broadcasting* signifying broadcasting by public institutions, including State governments, political subdivisions thereof, and universities and such others as may be licensed for the purpose of disseminating informational and educational service.

(3) *Private broadcasting*, signifying broadcasting without charge, by the owner of a station, as a communication company, a store, a newspaper, or such other private or public organization or person as may be licensed for the purpose of disseminating news, entertainment and other service; and

(4) *Toll broadcasting*, signifying broadcasting where a charge is made for the use of the transmitting station.

NOTE 2.—A station carrying on two or more of the broadcasting services specified in Classes 2, 3 and 4, must be licensed for each class of service.

NOTE 3.—When transoceanic radio telephone experiments are to be conducted, the Department of Commerce should endeavor to arrange with other countries for the use of the wave band, 5,000 to 6,000 meters assigned for this purpose.

NOTE 4.—The wave band, from 2,850 to 3,300 meters, may be used for fixed service radio telephone, only provided it does not interfere with service using continuous wave telegraphy.

NOTE 5.—The wave band, from 1,550 to 1,650 meters, is for use of radio telephone communication over natural barriers, but is not exclusive of other services.

NOTE 6.—Radio beacons are radio-transmitting stations which transmit signals from which a mobile direction finding station may determine its bearing or position.

NOTE 7.—Radio compass service is here used to signify a direction finding service in

Tune In With These Real Radio Batteries

Hook up a 6-volt Willard *All-Rubber* Radio "A" Battery to your filament circuit, and two or more 24-volt *Threaded Rubber* Radio "B" Batteries to your plate circuit. Then note the difference in the way your set stays tuned—in the freedom from hissing and frying noises. These batteries give you results because they are *built for radio.*

The 6-volt
All Rubber "A" Battery

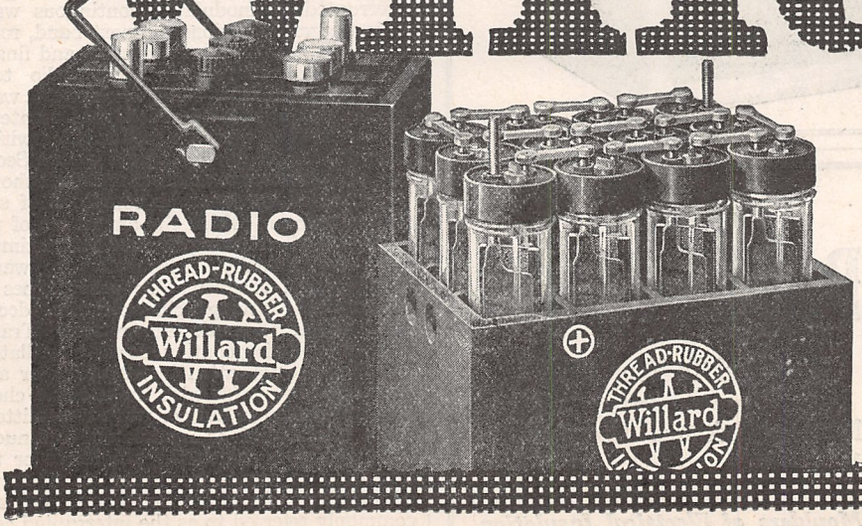
has special heavy Radio plates —Threaded Rubber Insulation— one-piece rubber container, which eliminates all possibility of leakage.

The 24-volt
Threaded Rubber "B" Battery

has glass jars, well separated to prevent leakage—Threaded Rubber Insulation—rubber screw-caps. Holds its charge, and is easily recharged.

WILLARD STORAGE BATTERY COMPANY, CLEVELAND, OHIO
Made in Canada by the Willard Storage Battery Company of Canada, Limited, Toronto, Ontario

Willard THREADED RUBBER BATTERY



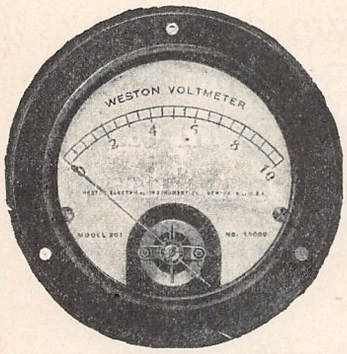
Write for particulars about the Willard "A" and "B" Radio Batteries, or ask the nearest Willard Battery Dealer.

Why Should I Use a

Weston

Filament Voltmeter

On My Receiving Set?



Model 301

Here's the Answer:

1.—It simplifies tuning by eliminating guesswork as to tube adjustments.

2.—Filament voltage control increases the life of tube from two to three times.

3.—The Weston Filament Voltmeter is accurate and can be relied upon for duplication of results.

All this Means

Better Reception

Buy it from your dealer, or from us direct if he cannot supply you. Write for Radio Circular J.

WESTON ELECTRICAL INSTRUMENT CO.

173 Weston Avenue, Newark, N. J.

Branches in the Large Cities

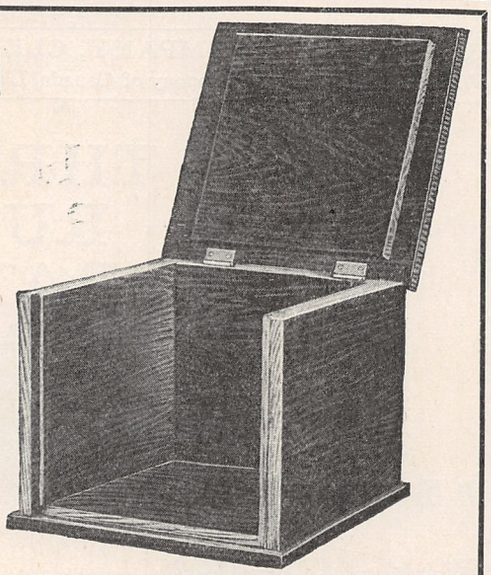
Startling Price Reduction

Handsome hardwood Cabinets, satin mahogany finish, hinged lid, front rabbeted to take panel.

You Will Be Proud of Your Set in This Cabinet

Prices—Postpaid in U. S., Delivery guaranteed. Cash with order. Panels not included in price.

Panel size	Inside dimensions High	Wide	Deep	Price
6x 7″	5½″	6½″	7″	$1.50
6x10½″	5½″	10″	7″	1.70
6x14″	5½″	13½″	7″	1.95
7x18″	6½″	17½″	10″	2.20
9x14″	8½″	13½″	10″	2.70
12x14″	11½″	13½″	10″	2.95



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MORSCAN

Wireless Supplies and Equipment at Wholesale

MORSCAN RADIO CO.

196 Market Street, Newark, N. J.

BAKELITE

RADIO PARTS

Moulded To Your Design

Northern Industrial Chemical Co.

11 Elkins St. Boston, Mass.

Moulders of Electrical Insulation

which a mobile station transmits to one or more fixed stations, which in turn transmit back the bearing or position of the mobile station.

NOTE 8.—The wave band, from 525 to 650 meters, is reserved for marine radio telegraphy, exclusive.

NOTE 9.—Assignment of waves in band 16 will, in general, involve keeping the zones from 285 to 315 and from 425 to 475 meters open in coastal regions. Furthermore, in border regions, account should be taken of the wave lengths used in neighboring countries, and these should be suitably protected by a locally unused band of adjacent wave lengths.

NOTE 10.—The restricted special amateur wave of 310 meters is for use by a limited number of inland stations and only where it is necessary to bridge large, sparsely populated areas or to overcome natural barriers.

NOTE 11.—City and state public safety broadcasting should in small cities be conducted by interrupting the broadcast service of Classes 2, 3 or 4, in case of emergency. In large cities this service will ordinarily have its own stations and will use the wave band, 275 to 285 meters, assigned to such service. Private detective agencies desiring to operate radio telephone broadcasting service should be required to cooperate with municipal or state services in the use of the wave band, 275 to 285 meters, assigned to the latter service.

NOTE 12.—By "technical and training school" in this report, is meant a school which in the judgment of the Secretary of Commerce is carrying on sufficient instruction of the proper character for training men for the radio profession to warrant the granting of a station license for that purpose.

NOTE 13.—An amateur is one who operates a radio station, transmitting, receiving, or both, without pay or commercial gain, merely for personal interest or in connection with an organization of like interest.

NOTE 14.—The Conference is of the opinion that broadcast transmitting stations should not in coastal regions be permitted on wave lengths closely adjacent to those assigned in the marine traffic, and believe that its recommendations provide for adequate protection of such marine traffic. The Conference recommends the assignment of wave lengths adjacent to those used in the marine traffic to inland stations under such conditions as to avoid interference with the marine traffic.

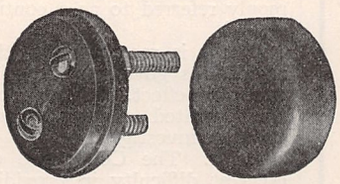
B. It is recommended that the Secretary of Commerce assign a specific wave length to each radio telephone broadcasting station (except Government and amateur stations), this of course being within the band pertaining to the particular service of that station.

C. It is recommended that the wave band assigned to amateurs, 150 to 275 meters, be divided into bands according to the method of transmission, damped wave stations being assigned the band of lowest wave lengths, interrupted or modulated continuous wave radio telegraph stations the next band, radio telephone stations the next band, and finally unmodulated continuous wave radio telegraph stations the band of highest wave lengths. It is recommended that amateurs be permitted to carry on broadcasting within the wave length band assigned by the Secretary of Commerce to amateur radio telephony.

A damped wave is one composed of successive trains in which the amplitude of the oscillation after having reached its maximum decreases gradually. This refers to waves from spark transmitters or other types of transmitters having characteristic decrement similar to spark transmitters. Transmitters employing continuous wave oscillators in which the variation in frequency or amplitude is abrupt (as with the use of a chopper), are classed as damped wave transmitters.

An interrupted or modulated continuous wave is one in which the amplitude or the frequency is varied according to a simple periodic law of audible frequency. (This is commonly referred to as the interrupted continuous waves, or I. C. W.) A continuous

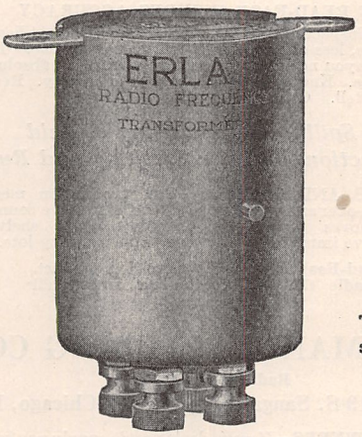
Dependable Radio Equipment for Immediate Delivery



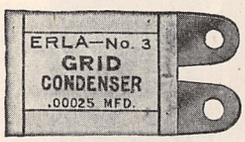
ERLA VARIABLE GRID LEAK

Pencil-mark type. Resistance may be varied exactly as needed.

List, 50c each



List, $6.00 each



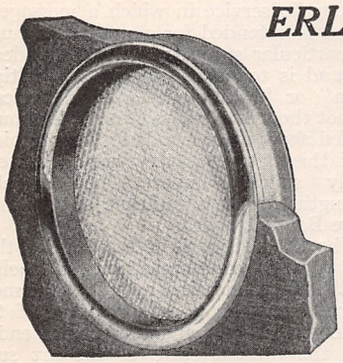
ERLA GRID CONDENSER

Type 3—.00025 M. F. D. Mounting holes spaced to fit lugs of Erla Grid Leak.

List, 25c each

ERLA RADIO FREQUENCY TRANSFORMER

This is the first transformer that successfully overcomes the high capacitance effects of domestic vacuum tubes. Furthermore, the capacitance effect of the transformer itself has been reduced to a degree heretofore unattained. As a result, a considerably higher step-up ratio is secured than with other transformers, necessitating the use of fewer stages for maximum over-all amplification. Get a transformer that will give the best possible results.



ERLA BEZELS

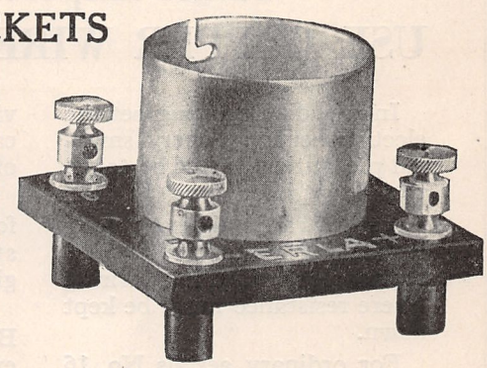
1½-in. diameter of highly nickeled brass. They will fit 1½-in. holes in any ⅛ to ¼ panel. These screened bezels add 100% to the neatness and attractive appearance of the panel of any radio cabinet.

List, 20c each

ERLA V. T. SOCKETS

Sturdy, dependable. Adapted to any American four-prong transmitting or receiving tubes. The rugged contact springs will not arc under the filament current of five-watt transmitting tubes. Very easily wired and unwired. The highly nickeled brass shell is mounted on polished black Radion base. A neat and efficient instrument.

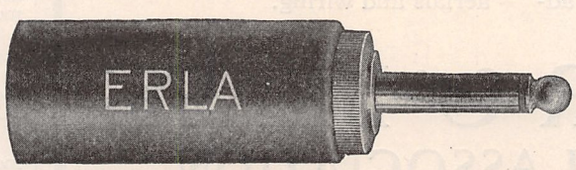
List, $1.00 each



ERLA PLUG

For use with telephone. Can be instantly connected or disconnected without tools. No need to cut or change telephone wire tips.

List, $1.00 each



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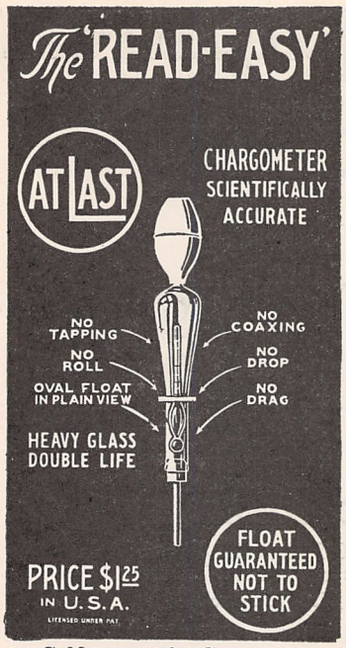

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DON'T RUIN YOUR BATTERY BY USING INACCURATE

BATTERY TESTERS

THE READ-EASY INSURES ACCURACY

Frequent inspection is your only insurance against heavy repair bills, loss of time and untold inconvenience. But a test tells you nothing unless your readings are absolutely accurate. Know the truth about your battery. Read-Easy will tell. Order yours today.

No Spilling or Splashing of Acid
A Protection for Your Clothing and Rugs

DEALERS AND JOBBERS—Our proposition means quick turn-over and volume sales. Our attractive counter display moves our goods off the dealers' shelves. We can give immediate delivery now in quantity lots.

Read-Easy is a quality, precision product. Handle the best hydrometer and you'll sell the most.

ALA MANUFACTURING CO.
Radio Dept. No. 12
401 to 419 S. Sangamon Street Chicago, Ill.

RADIO OWNERS—If your dealer can't supply you send $1.25 direct to us and we will send at once parcel post prepaid insured.

Radio Experts All Say:
USE COPPER WIRE FOR AERIALS

In a radio receiving set the electrical energy is very small. All precautions must be taken to prevent loss.

Copper ranks highest among conducting materials, and is, therefore, specified in all wiring where resistance must be kept down.

For ordinary aerials No. 16 hard-drawn copper wire is advised. For large aerials, use cable made up of seven strands of No. 20 or 22 copper wire.

Where high winds prevail, or for unusually long spans, stranded phosphor bronze gives splendid service.

Follow the advice of the U. S. Bureau of Standards and other experts and use Copper for aerials and wiring.

COPPER & BRASS
RESEARCH ASSOCIATION
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RADIO PARTS
We are specialists in
Bakelite Moulding
Send Us Your Drawing or Sample
PROMPT Deliveries
THE RIDGELY TRIMMER CO.
Springfield, Ohio, U. S. A.

12,000 OHM
NON-INDUCTIVE
RESISTANCE UNITS
FOR USE IN THE NEW ARMSTRONG SUPER-REGENERATIVE CIRCUIT

PRICE, $2.00 EACH

THE PROMETHEUS ELECTRIC CO.
513 West 42nd Street
Established 1901 NEW YORK

wave transmitter, employing a rectified plate voltage, which is not a substantially constant direct voltage, is classed as an interrupted or modulated continuous wave transmitter. Note: This included transmitters in which the variation in amplitude or frequency is effected in a gradual way only. (For abrupt variation see damped wave.)

An unmodulated continuous wave is one in which the permanent state is periodic and has substantially constant amplitude and frequency. (This includes waves in which the amplitude variation is effected simply by the manipulation of a key. This is commonly referred to as a continuous wave, or C. W.)

D. It is recommended that the present regulations governing experimental stations remain in effect. An experimental station is one operated exclusively for technical or scientific investigations.

E. 1. The Conference experienced the greatest difficulty in providing even partly for the generally demanded services. The Conference therefore disapproved of the elimination of essential services by the introduction of direct advertising which might be expected to require extensive assignment of wave bands if permitted at all.

2. Many services for which radio telephony might otherwise be desirable cannot practically be conducted by this means on account of the interference which such use would cause with other services of a more essential nature or for which there is great public demand.

3. In view of the demand for broadcast service by the general public, it is not desirable to disseminate information over wide areas for purposes of point-to-point communication except where that communication cannot be effectively maintained by other means.

4. A radio service in which a message is addressed or intended for a prescribed number of particular stations is not a broadcast service and is to be classed as a "multiple telegram" or "multiple telephone service." It was not thought advisable to use the much demanded short wave bands for communications of this nature as they would serve a relatively small number. The available wave lengths for such multiple service messages are Bands 2 and 5.

5. The Conference is of the opinion that the use of radio communication for "point-to-point" communication over land in most cases constitutes an uneconomic use of the available wave bands, and it is recommended that at the present state of the art such communication should be carried on by other means, insofar as possible.

6. The Conference very carefully considered the proximity of wave bands assigned to amateurs and broadcast services, but deemed it essential to utilize all of the available wave bands.

7. It was felt that waves longer than 275 meters should not be assigned to technical and training school stations because of the needs of broadcast services greatly desired by a large portion of the public in that zone, and because the extension of amateur wave lengths and the organization of their use will enable their effective employment by the technical and training school stations.

II. POWER LIMITATION, GEOGRAPHICAL DISTRIBUTION, AND HOURS OF OPERATION OF BROADCASTING STATIONS

A. It is recommended that the Secretary of Commerce assign to each radio telephone broadcasting station a permissible power based on the normal range of the station, such normal ranges for the different classes of service to have the following average values, larger or smaller values being discretionary where conditions warrant.

Government broadcasting stations, 600 (land) miles.

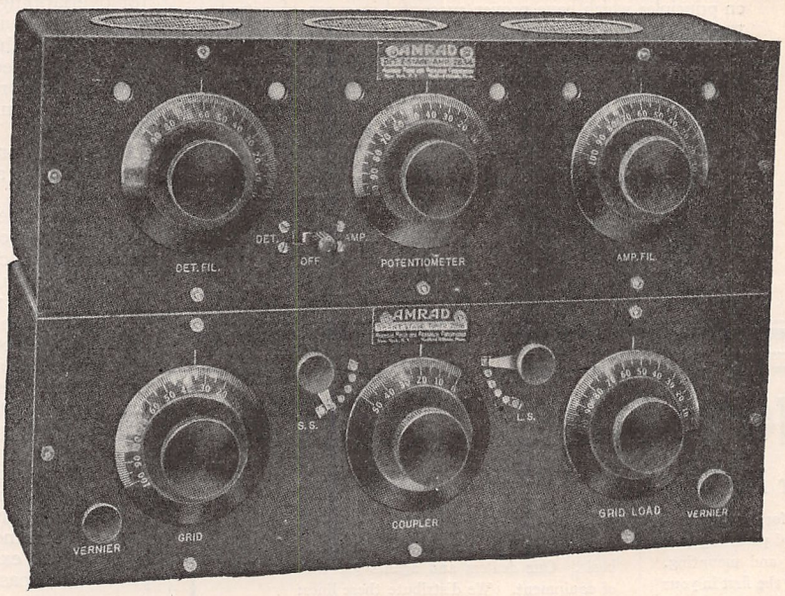
Public broadcasting stations, 250 miles.

Private and toll broadcasting stations, 50 miles.

AMRAD

The Recognized Symbol of Superior Performance

For Lasting Satisfaction



This Superfine Receiver

Amrad Short Wave Receiver, Including Tuner 2596, Price, $55.00, and Detector 2-Stage Amplifier 2634, Price, $65.00. Encased in Solid Mahogany Cabinets.

What Owners Say

Philadelphia reports: "Heard Omaha, Nebraska, a number of times this spring."

Boston writes: "I get Chicago, WWJ, and Madison, Wis., with an indoor antenna, using 125 volts on the amplifier."

Los Angeles hears Seattle.

New York writes: "Almost always I am able to tune in either Medford Hillside, Mass., Pittsburgh, or WGY, Schenectady, while Newark is broadcasting. 'Amrad for sharp tuning, say I.'"

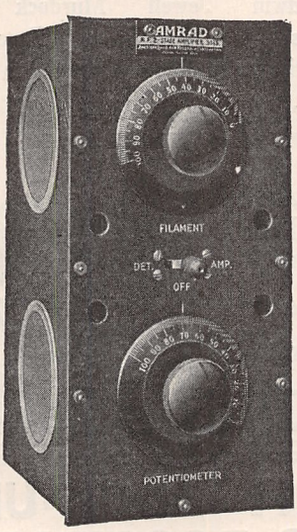
Another owner reports: "We can pick up at least six of the big broadcasters. I bought your Amrad set for my boy, but he is not so keen about it as his dad. I had no previous radio experience."

Denver, Col., hears Fort Worth, Texas, on the Amrad.

A Florida man writes, "I am touring the East by automobile and use the Amrad every time I camp out for the night. At Durham, No. Carolina, we got Pittsburgh, Newark and Schenectady. I had a three-wire aerial tossed over the limb of a tree," etc.

These extracts from enthusiastic owners are only a few of the unsolicited reports, but we consider them typical. Investigate this Amrad Receiver for yourself at your nearest dealer's. Order from him. If he does not stock, he will secure it for you quickly. Look for the green and yellow labels in the best stores.

Send 10c for complete catalog.



R. F. AMPLIFIER 3057-1, Price, $30.00.
RADIFORMERS (R.F. Amp. Transformers), Price, Each, $5.00.

Why Amrad Performs

Amrad BASKETBALLS—Variometers and Vario-Coupler—incorporating the exclusive basket weave windings, are employed in the Tuner.

Amrad Ampliformers, avoiding conventional leaky, lap joints, and thus assuring maximum signal strength, are used in the Detector 2-Stage Amplifier.

These two features of design, plus many years of radio manufacturing experience, have produced the highly sensitive and efficient Amrad Receiving Set. Yet the price is no greater, and more often less, than any first class quality receiving equipment available today.

Bulletin L, mailed upon request, describes the Amrad Receiver in detail. Bulletin O describes the BASKETBALLS, and Bulletin N the Ampliformers. Send for these bulletins.

Nothing has provoked greater interest in recent years than the application of radio frequency to broadcast receiving sets.

The New Amrad R. F. 2-Stage Amplifier, illustrated, invites the attention of anyone wishing to obtain results beyond those possible with audio frequency amplification only.

Bulletin R contains useful R. F. information every owner of a vacuum tube set should have.

AMERICAN RADIO AND RESEARCH CORPORATION

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General Office, Factory and Laboratory
203 College Avenue, Medford Hillside, Mass.

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Model 501 Thorophone Complete with Concert Horn. Price.....$35.00

THOROPHONE FOR TONE

REAL MUSICAL REPRODUCTION

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(THUNDERPHONE)

TRADE MARK REG.U.S.PAT. OFFICE

The THOROPHONE is more than a loud speaker—it is *a real musical instrument.* If you have never heard the THOROPHONE its clear, beautiful and satisfying tone will astonish you. Produced by America's oldest manufacturers of loud speaking telephones, it is based on principles which have proven successful in years of actual use. With the THOROPHONE, Radio becomes a real means of musical enjoyment, not merely an interesting novelty. After you have once heard this real musical instrument no other loud speaker will satisfy you. The THOROPHONE requires better than the average receiving set to give best results, but give it the power and you will be astonished at its musical qualities.

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4801 SO. MORGAN ST. CHICAGO, ILL.

Mail Orders attended to promptly. Send money order, check or draft with order.

DEALERS—Write for full details regarding our proposition.

ARMSTRONG'S SUPER-RECEIVER

Special Parado Offer No. 7

The latest in radio receiving circuits for extreme long distances. Complete list of standard parts together with detailed blueprints for wiring and mounting. Start now to assemble your set. Be the first in your locality.

Complete Parado Super-receiver No. 7, $72.80

We make a specialty of first-class material and latest developments.

All high-grade standard apparatus used

Write for other combination offers and FREE PRICE BULLETIN P-16

Peoria Radio Sales Co.

Dept. B

PEORIA, Illinois

Special Dealer Plan

Dealers:—Write for our new plan on distribution. We are taking orders on monthly allotment basis. Our dealers and agents get the best lines of equipment. We distribute these lines:

Acme Clapp-Eastham Grebe
Adams-Morgan DeForest Moorhead
Baldwin Jewell Murdock
Brandes Federal Pacent
Westinghouse Radio Corporation

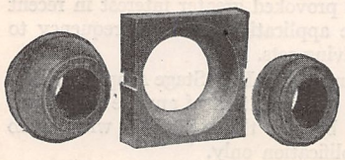
Write today for New Dealers' Discount Schedule No. 8

KLAUS RADIO CO.

Dept. 200

Eureka, Ill.

FIRST TESTED—THEN SOLD



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Quick Deliveries. Write for prices.

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with the VARIOFONE

Multiple panels, all interchangeable, folding front and sides. Substantial, solid mahogany. Designed to be expanded at will by the amateur, making set any desired size.

AS A CABINET ONLY.....$18.00
AS A COMBINATION OF CRYSTAL AND AUDION DETECTOR.....$40.00
10 tested galena crystals..... 1.00
Crystal sets with antennæ and phones, complete.....$12.00 to $20.00
All other radio supplies. Correspondence invited from dealers and amateurs. Circulars free.

VARIOFONE COMPANY

5 Columbus Circle New York City

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year. Experimenter Publishing Co., 53 Park Place, N. Y. C.

Normal range is the average reliable daytime ranges over which satisfactory communication can be obtained with good available receiving apparatus.

The Conference recommends that broadcasting stations should not be allowed to use unlimited power because of the fact that this will limit the number of services which can be rendered within a given area to an undesirable extent.

(NOTE.—The Bureau of Standards of the Department of Commerce should make a study of the relation between the normal reliable range of a station and the antenna power on the basis of the use of good available receiving apparatus. It is recognized that this relation may change with the development of the radio art.)

B. It is recommended that the same wave (or overlapping wave bands) not be assigned to stations within the following distances from one another, except that these distances may be lowered if the normal ranges of the stations are correspondingly lowered.

For Government broadcasting stations, 1,500 miles.

For public broadcasting stations, 750 miles.

For private and toll broadcasting stations, 150 miles.

(NOTE.—The Bureau of Standards should make a study of the width of wave band (expressed in cycles per second) required for satisfactory radio telephony. It is recognized that this width depends on the methods of transmission and reception employed.)

C. It is recommended that the Secretary of Commerce cause an immediate study to be made of the best geographical distribution of broadcasting stations, with the view of attaining the best service with a minimum of interference.

D. It is recommended that in cases where congestion of radio telephone broadcasting traffic exists, or threatens to exist, the Secretary of Commerce assign suitable hours of operation to existing or proposed radio telephone broadcasting stations.

III. CONSIDERATIONS TO BE FOLLOWED IN GRANTING LICENSES

A. It is recommended that in the case of conflict between radio communication services first consideration be given to the public not reached, or not so readily reached, by other communication services.

B. It is recommended that subject to public interest and to the reasonable requirements of each type of service the order of priority of the services be Government, Public, Private, Toll.

C. It is recommended that the degree of public interest attaching to a private or toll broadcasting service be considered in determining its priority in the granting of licenses, in the assignment of wave frequencies, and in the assignment of permissible power and operating time, within the general regulations for these classes of service.

D. It is recommended that toll broadcasting service be permitted to develop naturally under close observation, with the understanding that its character, quality and value to the public will be considered in determining its privileges under future regulations.

E. It is recommended that direct advertising in radio broadcasting service be absolutely prohibited and that indirect advertising be limited to a statement of the call letters of the station and of the name of the concern responsible for the matter broadcasted, subject to such regulations as the Secretary of Commerce may impose.

F. It is recommended that when all available wave frequencies in any geographical region are already assigned, no further licenses for broadcasting be granted in that region until cause arises for the revocation of existing licenses.

G. It is recommended that private or toll broadcasting stations transmitting time signals shall transmit only official time signals, and with authorization from and under conditions approved by the Secretary of Commerce.

listen in on this!

This is CFC . . . CFC . . . Newark, Delaware!

Allow us to tell you plainly and frankly that the best material in the world for panelling and basing your Radio set and for insulating other parts of your equipment is

bakelite-dilecto!!

Radio professionals and amateurs everywhere are praising this remarkable material for its thorough insulation, elimination of vibration and professional appearance. Our X.X. grade has proved perfect for the purpose wherever tried.

Used by the UNITED STATES NAVY and SIGNAL CORPS for over EIGHT YEARS! That IS a testimonial! Positively guaranteed highest in dielectric and tensile strength (dielectric constant 5.2). Proof against heat, water and milder acids. Astonishingly hard and tough; yet easily machined. Can't warp or swell. Efficient.

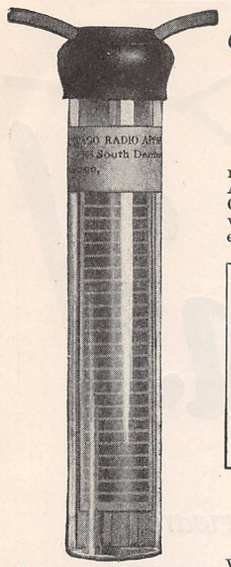
Your electrical supply man can get Bakelite-dilecto X.X. cut to your exact requirements. Tell us you want to know more about this and all the information we have is yours by return mail. Write:

The Continental Fibre Company

Factory—Newark, Delaware

Dealer service from:

NEW YORK	233 Broadway
ROCHESTER	85 Plymouth Ave. S.
CHICAGO	332 S. Michigan Ave.
PITTSBURGH	301 Fifth Ave.
SAN FRANCISCO	75 Fremont St.
LOS ANGELES	411 S. Main St.
SEATTLE	91 Connecticut St.



"CHI-RAD" APPARATUS

New Storage "B" Battery

At last a real Storage "B" Battery for your radio set. Can be used on receiving apparatus as source of plate voltage on both Detector and Amplifier tubes. Ideal as plate potential on small Radio Telephone or C.W. Transmitters. When discharged do not have to be discarded as with ordinary "B" Batteries, but can be recharged again and again exactly like your "A" Battery.

SPECIFICATIONS

Cut one-half natural size.
Voltage per cell, 2 volts.
Pasted plates, ready formed for use. This means long life, battery ready for use upon the first charge given.
High ampere hour capacity—will operate one detector tube over 1000 hours with one charge. Shipped dry with simple directions for preparing the electrolyte.
NOTE:—A 22-volt battery of these cells costs but $6.00 complete with base.

**"GIVE US YOUR BUSINESS—
WE'LL GIVE YOU SERVICE YOU WILL LIKE"**

DEALERS

Write for discounts and territory on this new item—the demand will be heavy. Chicago Amateurs:—Come and inspect this battery and our general stock of Radio Apparatus—largest in the Middle West.

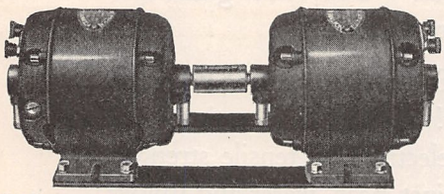
**Price per cell, $0.40
Add PP on ½ lb.
per cell**

CHICAGO RADIO APPARATUS CO., Inc.

415 So. Dearborn St. CHICAGO, ILL.

Radio Motors—Motor Generators and Charging Sets

Immediate Shipment at Bargain Prices



We offer, for immediate shipment subject to prior sale, a stock of new motors and generators, just received from the factory, at the following remarkably low prices:

⅛ h. p., 110 volt, 60 cycle, A. C. Synchronous Motors, for operating spark gap..... **$20.00**

¼ h. p. Motor and Generator Set, 110 volt, 60 cycle, for charging "A" Batteries..... **$35.00**

½ h. p., 110 or 220 volt, 60 cycle, A. C. Combined Motor Generator Set with low voltage for charging "A" Battery and 500 volts for broadcasting..... **$100.00**

General Purpose Motor, for household garage and factory use— ¼ h. p., 110 volt, 60 cycle, operating at 1,740 r. p. m..... **$13.50**

Prices f. o. b., Chicago. Send cash with order. Purchase price will be refunded upon return of goods within 30 days if found unsatisfactory.

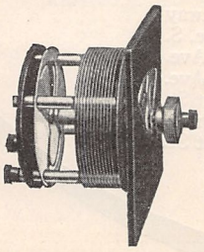
NORTHWESTERN ELECTRIC COMPANY

412 S. Hoyne Avenue, CHICAGO

PRECISE VARIABLE CONDENSERS

**Vernier Adjustment
Maximum Efficiency**

**.0002 Mfd.
.0005 "
.0012 "
Capacity**



Model No. 265 Of Interest to Dealers

PRECISE MANUFACTURING CORPORATION

ROCHESTER, - - N. Y.

SEPTEMBER SLAUGHTER!!!

Sent postpaid, insured, anywhere, upon receipt of money order, cash or check. Storage Batteries shipped express collect.

$5 Detector Tubes $3.75—$1.50 Cyclone 22½ V. Variable B Batteries 95c—$1.00 U. S. Hard Rubber Dials 50c—35c Galenas Mounted and Tested 15c—60c Switch Levers 35c—10c Nickelled Binding Posts (Dozen 50c) Each 5c—$3.50 Double Slide Tuning Coils $1.95—$3.75 23 Plate Variable Condensers $1.95—$4.75 43 Plate Variable Condensers $2.75—6 Volt U. S. Guaranteed Storage Batteries $7.50 Up.

BROADWAY ELECTRIC NOVELTY HOUSE

216 Seventh Ave. — Near 23d St. — New York, N. Y.

H. It is recommended that the transmission of signals of such character or wave length as to deliberately interfere with the reception of official time signals constitutes grounds for the revocation or suspension of the transmitting station or operator's license.

I. It is recommended that license requirements for the operator of a radio telephone transmitting station include a knowledge of radio transmitting and receiving apparatus and of the International Morse Code, sufficient to receive at a rate of not less than ten words per minute.

J. It is recommended that the establishment at any later date of any commercial transmitting stations having more than 1 k.w. input to the antenna may, at the discretion of the Secretary of Commerce, be prohibited within twenty-five land miles of a Government or commercial station or in regions where congestion of radio traffic shall warrant such prohibition.

K. It is recommended that the sharpness of the emitted wave of the transmitting station affect the privileges extended to such station.

IV. RECOMMENDATIONS RELATIVE TO THE AMATEUR

A. It is recommended that the status of the amateur be established by law and that the limits of the wave band allotted to the amateur, as given above in Section I, be specified in the law.

B. It is recommended that the amateur continue to be under the jurisdiction of the Department of Commerce.

C. It is recommended that for the purposes of self-policing among the amateurs, amateur Deputy Radio Inspectors be created, elected from their number of the amateurs of each locality; that upon receipt of notice of such election the Radio Inspector in charge of the district in which such amateurs are located shall appoint the person chosen a Deputy Radio Inspector, serving without compensation or for the sum of one dollar per year if compensation is legally required; that the duty of such amateur Deputy Inspector shall be to endeavor to the best of his ability to accomplish, under the direction of the District Radio Inspector, observance of the Radio Communication Laws and the Regulations of the United States, and the observance of such local cooperation of measures as are agreed to in each community for the minimization of interference between the various groups of the public interested in radio; that such Amateur Deputy Inspectors be clothed with whatever authority may be necessary in the opinion of the district radio inspector.

V. TECHNICAL METHODS FOR THE REDUCTION OF INTERFERENCE

A. It is recommended that the Secretary of Commerce at his discretion prohibit at any time the use of existing radio transmitting apparatus and methods which result in unnecessary interference, provided that such action should not be taken unless more satisfactory apparatus and methods are commercially available at reasonable prices and until an adequate time interval is allowed for the substitution of the more satisfactory apparatus.

B. It is recommended that the Secretary of Commerce at his discretion prohibit at any time the use of existing radio receiving apparatus which cause the radiation of energy, provided that such action should not be taken unless more satisfactory apparatus and methods are commercially available at reasonable prices and until an adequate time interval is allowed for the substitution of the more satisfactory apparatus

NOTE.—"Certain forms of oscillating receivers cause the feebler radiation of continuous waves, and may therefore be a source of local interference."

C. It is recommended that the Bureau of Standards make a study of the technical methods for the reduction of interference, with a view to publishing their findings, giving special attention to the following:

The RADIOGEM

(Patents Pending)

$1 Receiving Set—The Simplest Radio Outfit Made—Yet as Practical as the Most Expensive!

You need know absolutely nothing about wireless to operate and enjoy the RADIOGEM. It is so sturdy, so simply constructed that it is small wonder radio *engineers who have tested* it have pronounced the RADIOGEM a brilliant achievement. The RADIOGEM is a crystal radio receiving set for everyone at a price anyone can afford.

Why The RADIOGEM Can Be Sold For Only $1

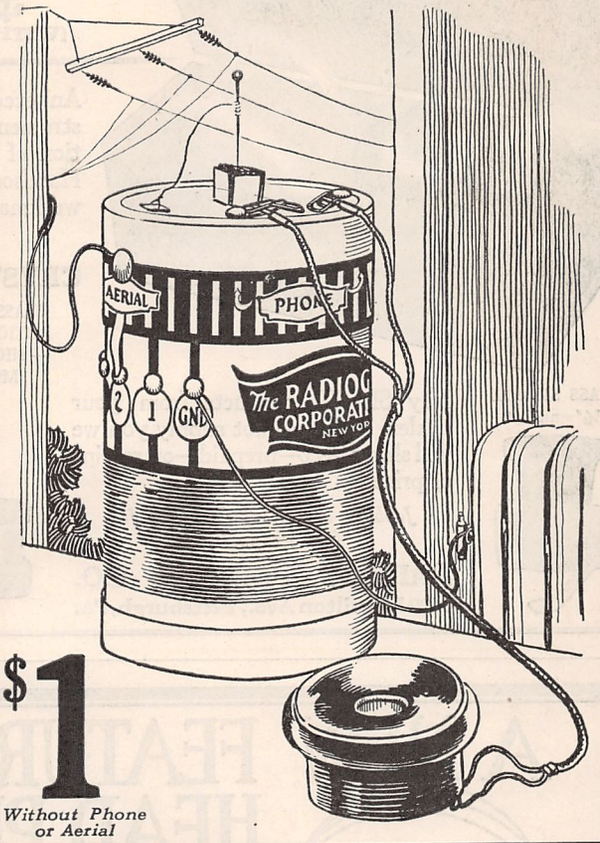
Here's the secret: The RADIOGEM Construction eliminates all unnecessary trimmings, cabinets and the like, which do not play any part in the operation of a set. You receive the RADIOGEM unassembled, together with a clearly written instruction book, which shows you how to quickly and easily construct the set, using only your hands and a scissor. The outfit comprises all the necessary wire, contact points, detector mineral, tube on which to wind the coil, etc., etc. The instruction book explains simply and completely the principles of radio and its graphic illustrations make the assembling of the RADIOGEM real fun. Remember the RADIOGEM is a proven, practical radio receiving set and will do anything the most expensive crystal set will do.

The RADIOGEM is the Prize Winner of the Age

Out of hundreds of radio models submitted recently in a great nation-wide contest, radio engineers, the judges, unanimously chose the RADIOGEM as the winner—the simplest radio-receiving set made! And the RADIOGEM costs you nothing to operate; no form of local electricity is required.

DEALERS The RADIOGEM is the wonder item of the radio age. It will storm the country, for the RADIOGEM'S price is so low everyone is able to buy one. Write immediately for full particulars before that shop across the street beats you to it.

Hear the programs of the Broadcasting Stations on the RADIOGEM



Receives up to 20 Miles

The RADIOGEM CORPORATION
42-R HUDSON STREET
NEW YORK CITY

Take One to Camp or on That Motor Trip

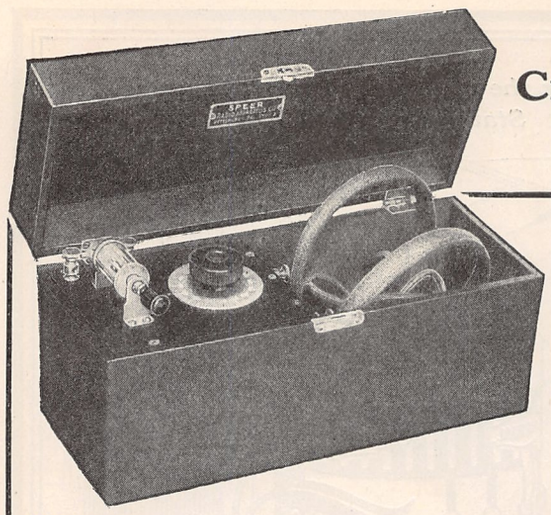
$1
Without Phone or Aerial

Radio Company

FOR SALE

WELL KNOWN and long established Radio Corporation, manufacturing a line of popular instruments and owners of a number of patents, tools, dies, trademarks, etc., as well as a large stock of goods, is for sale. This is an opportunity to acquire a going business that can be easily and quickly developed into one of the biggest of its kind in the industry. Write for full particulars.

Box 800, care of *Radio News*, 53 Park Place, N. Y.



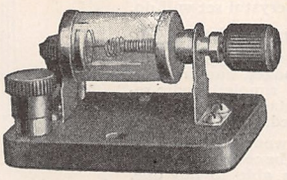
SPEER
Crystal Receiver
$9.00
(WITHOUT PHONES)

An exceptionally efficient instrument designed for the reception of local Radio Concerts. Handsome cabinet — finest workmanship throughout.

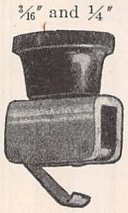
SPEER CRYSTAL DETECTOR

GLASS ENCLOSED — SPRING ACTION — MOULDED BASE — NICKEL FINISH — WITH MOUNTED CRYSTAL

$2.00



BRASS SLIDERS
3/16" and 1/4"

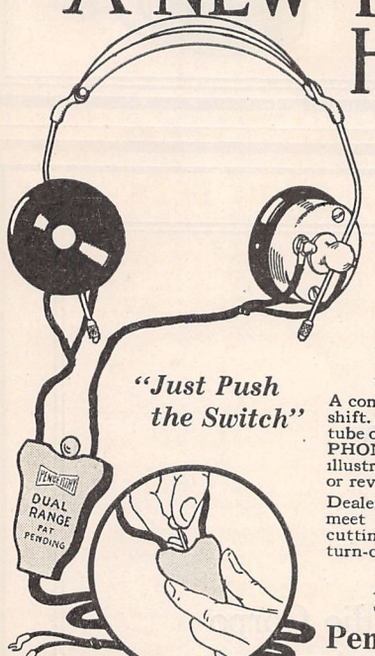


Buy SPEER products from your dealer. If he cannot supply you we will ship direct—prepaid—on receipt of price.

Jobbers and Dealers Write for Our Proposition

RADIO APPARATUS CO.
6600 Hamilton Ave., Pittsburgh, Pa.

A NEW FEATURE IN HEAD PHONES



PENBERTHY PRODUCTS

DUAL RANGE

"Just Push the Switch"

750 Ohms to 3000 Ohms

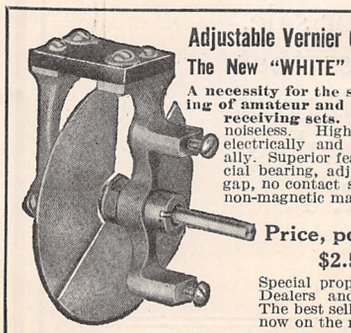
It is a well known fact that a head set of 750 ohms resistance is most efficient on a receiving set of the crystal type, whereas 3000 ohms resistance gives best results with a vacuum tube outfit.

A compromise between these two extremes is only a makeshift. Therefore, to get best results on either type (vacuum tube or crystal), use the new PENBERTHY DUAL RANGE PHONE. Pushing in or pulling out the plunger (shown in illustration) changes the resistance from 750 to 3000 ohms, or reverse.

Dealers and jobbers will welcome this new device. It will meet all requirements with one style of head phone—thus cutting down the investment in stock and increasing the turn-over. Full details to jobber or dealer on request.

LIST PRICES
Dual Range Phones, 750 to 3000 Ohms . . $8.50
Single Range Phones, 3000 Ohms 7.00

Penberthy Injector Company, DETROIT Michigan



Adjustable Vernier Condenser
The New "WHITE" Type 1VC

A necessity for the sharp tuning of amateur and broadcast receiving sets. Absolutely noiseless. Highest grade, electrically and mechanically. Superior features, special bearing, adjustable air gap, no contact springs, all non-magnetic materials.

Price, postpaid, $2.50

Special proposition for Dealers and Jobbers. The best selling device now on the market.

The O. C. WHITE COMPANY
15-21 Hermon Street, Worcester, Mass.

TRESCO
Sectional UNIVERSAL Radio Outfits
Licensed under Armstrong U. S. Patent No. 1,113,149

The Set Consists of Three Units:

Tuner and Detector Unit	$ 50.00
Two-Step Amplifier Unit	35.00
Unit for holding "A" Battery	9.50
Top and Bottom, which when added to the three other units, make a complete section all in one. Each, $5; both	10.00
Complete Set, Total	$104.50

Ask your dealer; if he cannot supply you, write us, Dept. 806.

TRESCO RADIO
Davenport, Iowa, U.S.A.

(1) The reduction of the rate of building up (increment) of oscillations in radiating systems. (This rapid building up of oscillations occurs in damped wave and interrupted continuous-wave transmitters, and may, of course, be eliminated by the substitution of other types of transmitters. It may, however, be reduced in these types by proper circuit arrangements.)

(2) The reduction of harmonics in continuous wave transmitters and of irregularities of oscillation. ("Mush" in arc transmitters and "swinging" of the frequency in some continuous wave transmitters not employing a master oscillator.) "Mush" signifies small sudden irregularities occurring in the antenna current of arc transmitters. Swinging signifies relatively slow changes in the frequency of a transmitted wave.

A harmonic of a wave is a wave whose frequency is a multiple of that of the given wave. (The wave length of a harmonic is thus a sub-multiple of the wave length of the given wave.) It is often convenient to include as harmonics frequencies which are dependent on the frequency of the transmitter, but which are not exact multiples.

(3) The comparison of the variable amplitude method with the variable frequency method of continuous wave telegraphy.

(4) The preferable methods of telephone modulation to avoid changes in the frequency of oscillation.

(5) The proper circuit arrangements of regenerative (including oscillating) receivers to avoid radiation of energy (as by the use of a radio-frequency amplifier with an untuned antenna or with a coil aerial.)

(6) The use of highly selective receiving apparatus, including a list of approved forms. Note: A selective receiver is one which enables the user to hear a desired signal and to exclude the undesired signals. The more perfectly this is accomplished, the more highly selective is the receiver.

(7) The use of receiving coil aerials instead of antennæ, with special reference to high selectivity.

(8) The reduction of interference with radio communication of other electrical processes, such as the operation of X-ray apparatus and electrical precipitation.

(9) The study and standardization of wavemeters. Note: A wavemeter is an instrument for measuring wave frequency or wave length.

At a subsequent meeting of the full conference called by Secretary Hoover on April 17, 18, and 19, 1922, it was agreed to add to Section 1 C, the provision that the operation of Government stations be conducted in such a manner as not to interfere with the commercial traffic and broadcasting, and that whenever Government-owned stations are used for the transmission of commercial traffic and broadcasting, they shall conform to the regulations established by the Secretary of Commerce.

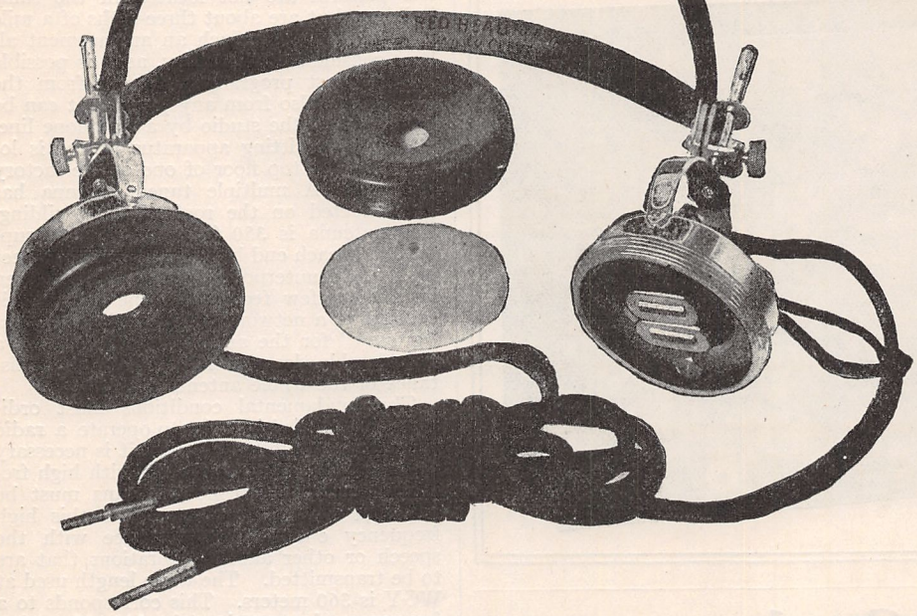
It was agreed to add a provision for the appointment by the President of an Advisory Committee to the Secretary of Commerce to consist of not more than twelve members, half of whom shall be from the Government, and half from outside the Government.

Operating Features of General Electric Radio Station WGY Schenectady, N. Y.

A radio broadcasting station, in order to faithfully transmit music and other forms of entertainment, must be equipped with apparatus of very high quality. In the WGY station of the General Electric Co., at Schenectady, N. Y., particular reference has been paid to this point, with the result that the radio equipment contains numerous refinements not to

"RED-HEADS"

A Triumph in Radio Receiver Design



3000 ohms, complete with cord and head band

—now

$6.50

at your dealers or prepaid direct on receipt of price

At the new price of $6.50 per pair, "Red-Heads" represent today's BIGGEST VALUE in radio head sets

SPECIFICATIONS

Each receiver wound to 1500 ohms (3000 ohms per pair) with highest quality electrolytic copper on accurately ground pole-pieces attached to the best magnet steel procurable for the purpose. Machine-finished aluminum backs with strain posts and nickeled binding posts. Ear caps of scientific design, moulded from our special red-brown composition, comfortably fitting the ear. High quality, fully adjustable, military type head band with seamless tape binding. Green mercerized cord. Careful workmanship and distinctive appearance. Fully guaranteed.

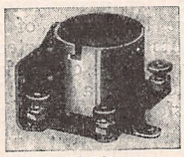
"RED-HEAD" Phones at $6.50 are the lowest priced, high-grade, 3000-ohm, aluminum-cup receivers on the market. The new price is possible only because of greatly increased production and facilities. Not one iota of quality has been sacrificed.

The same super-sensitive, clear-toned "Red-Head" Receivers—tested and approved for seven years by the critical amateur fraternity—originally priced at *$12.50* and then *$8.00*—are now yours for the amazing price of *$6.50*.

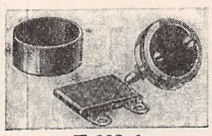
You, the purchaser, assume no risk! Our money-back guarantee places the burden of responsibility with us. If "Red-Heads" are not SURPASSINGLY GOOD we'll cheerfully refund the purchase price.

"TEAGLE"—BETTER RADIO ACCESSORIES

T-100
—a *better* reversible rheostat
$1.00



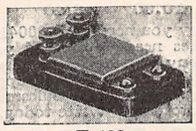
T-101
—a *better* vacuum tube socket
75c



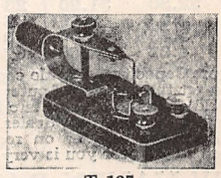
T-103-4
—a *better* grid condenser and grid leak unit
$1.00

Grid Leak 60c
Condenser 40c

T-106
—a *better* phonograph adapter
$1.00



T-102
—a *better* stopping condenser
75c



T-105
—a *better* crystal detector
$1.00

BUY FROM YOUR RADIO DEALER IF YOU CAN, OR ORDER DIRECT, ENCLOSING PRICE

Dealers: Send for our interesting proposition

The Newman-Stern Co

Newman-Stern Bldg., Cleveland, Ohio

Manufacturers and Distributors of Standard Radio Materials

MEET THE PERFECTO-VOX

(PERFECT VOICE)

ALL THE NAME IMPLIES

A New Product by an Old Manufacturer of Quality Products for 17 Years

Attractive Proposition for Dealers and Jobbers

When Better Receiving Sets Are Built Scripps Will Build Them

PRICE $90.00

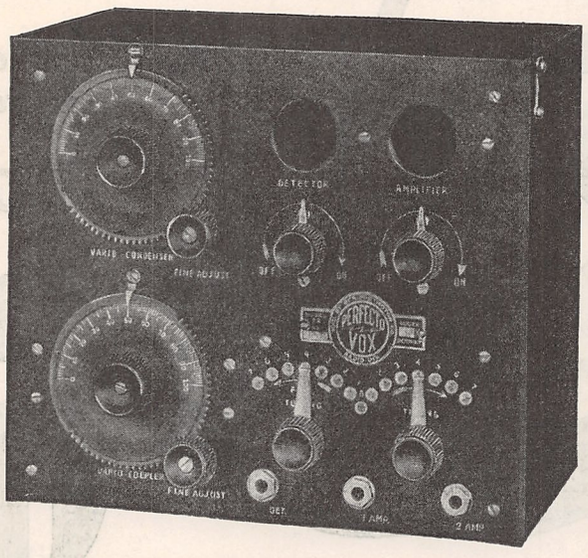
SPECIFICATIONS

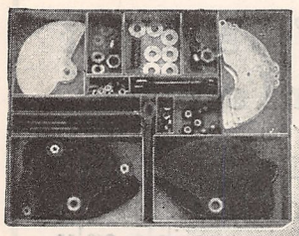
Non-Regenerative
Vernier Controls
Filament Control Jacks

DETECTOR

Two-Step Amplifier
180-750 Meters
400 Mile Range
Size: 9" x 10½"—6¼"

THE SCRIPPS MOTOR COMPANY
RADIO DIVISION
DETROIT, MICHIGAN





Front and back plates of selected hard rubber. Central mandrel, adjusted through one or more cone bearings, turns in a brass bushing. Plates and separators of especially prepared highest quality aluminum, CANNOT GET OUT OF TRUE.

Your Condenser— *Build It Yourself*

THE MARSHALL WAY

SAVE money. You can purchase material for any size *Marshall Variable Condenser* you wish—for a condenser suited exactly to fill the capacity requirements of *your own* set.

Condenser comes either completely assembled, or in knock down form, ready-to-build.

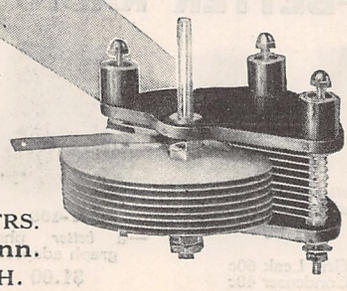
Take pride in your own handiwork — satisfy yourself with the saving in cost.

PRICES of MARSHALL CONDENSERS
Assembled or Ready-to-Build

Note substantial price savings on this quality Radio equipment.

No. of Plates	Price, Assembled	Price, Ready-to-Build	No. of Plates	Price, Assembled	Price, Ready-to-Build
3	$2.50	$1.90	23	$5.25	$3.80
5	2.75	2.10	35	6.00	5.15
9	3.50	2.55	43	6.50	5.80
17	4.25	3.35	67	10.00	8.40

To figure Capacity: Divide capacity you need by .000041 MFDs to get the number of outer plates needed to build your set. Add one extra outer plate for any fraction in the answer.
Order at once from your dealer, or direct if he cannot supply you. Illustrated circular on request. Retailers—Salesmen! Our proposition for you is very interesting. Write today.



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Chapel and Hamilton Sts., New Haven Conn.
ORDER NOW AND AVOID THE HOLIDAY RUSH.

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Manufactured by
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be found in standard radio telephone transmitters. When radiophone apparatus first came into more or less general use, several attempts were made at broadcasting music, and while many of these tests were quite successful it was found that equipment that would give satisfactory speech quality was not always particularly suitable for music transmission. Consequently a large amount of experimental work was done to improve the quality of transmission with the result that both music and voice are now faithfully reproduced.

The accompanying description is intended to give the radio fan some idea of the manner in which the WGY station operates. Contrary to general opinion the radio transmitting apparatus and the studio where the artists perform are not located in the same building, but are about three-fifths of a mile from each other. Such an arrangement allows considerable flexibility, as it is possible to broadcast programs not only from the studio, but also from any point that can be connected to the studio by a telephone line.

The transmitting apparatus proper is located on the top floor of one of the factory buildings. A multiple tuned antenna has been erected on the roof of this building. The antenna is 350 feet long, and is supported at each end by a steel tower, 180 feet high. A counterpoise system has also been installed a few feet above the roof. This consists of a network of wires that act as a "ground" for the antenna and result in a considerable decrease in the effective resistance of the whole antenna system.

The fundamental conditions must ordinarily be fulfilled in order to operate a radio telephone transmitter. First, it is necessary to supply the antenna system with high frequency energy. Secondly, means must be provided to control or modulate this high frequency energy in accordance with the speech or other audible vibrations that are to be transmitted. The wave length used at WGY is 360 meters. This corresponds to a frequency of approximately 833,000 cycles. The manner in which alternating current of this frequency is produced by the transmitting apparatus may be described as follows:

The power supply for the transmitter is three phase, 60 cycles, at a potential of 110 volts. This source furnishes practically all the power for the entire equipment. Two types of vacuum tubes are used, namely, Kenotrons or two element tubes, and Radiotrons or three element tubes. The filament of the Kenotron is heated from the secondary of a step-down transformer. A direct current generator is used to supply the Radiotron filaments.

The plate circuit of the Radiotron power tube requires high voltage direct current at a potential of about 12,000 volts. This is obtained from the Kenotrons which are connected through a suitable rectifying circuit to the secondary of the high voltage plate transformer. A filter system is connected in the rectifying circuit in order to remove the A.C. hum that would otherwise be present. The high voltage output of the Kenotron rectifier then passes into the Radiotron tubes, where by means of the proper oscillating circuits it is converted into radio frequency energy. The oscillating circuits are coupled to the antenna system by means of an air core transformer, commonly known as an oscillation transformer. Therefore, by means of the vacuum tubes and their associated circuits we are able to take power at 110 volts and 60 cycles and convert it into radio frequency power at several thousand volts and practically any desired frequency.

In order to understand how the modulation or audio frequency control of the antenna current takes place we must begin at the studio where the artists perform. Three rooms are utilized at the studio, one being used as a reception room, one containing pianos, organs and other musical instruments and the third containing the controlling and amplifying apparatus. The only apparatus located in the room where the artists perform

An Open Letter to the Radio Jobber, Dealer, Expert and Amateur

Radio is fast outgrowing stirring articles on fanciful inventions. It has become a stable business institution which will total fully $50,000,000 this year.

The future of this industry, its welfare and growth must be safeguarded. Pirating and cut-price tactics, flooding the market with cheap, unsatisfactory apparatus is certainly bringing the gavel of discontent down on the heads of a growing throng of enthusiastic fans.

We in this industry must protect the cause we have labored to build up. To this end the Ra-Di-Co Organization pledges its support and stands "pat" as a pioneer radio institution.

We have held a sympathetic hopeful attitude during the early days of radio experimentation. We now appeal to the fair-minded judgment of practical business and professional men to aid us in rescuing this industry from exploiters of radio junk; rank fly-by-night up-starts, bootleggers and vulgar intruders who menace rather than promote a naturally promising industry.

This business has a perfectly just right to be here; a better right to grow, and in this field is legitimate room for new experiments and developments.

But there is no room for hold-up shysters who endeavor to pocket gilt-edge profits through misrepresentations, false claims and defective apparatus.

To the Promotion of the cause through personal service, tested apparatus, stabilized list prices and fair profits, we as a corporate body pledge our united support. We are strongly organized to do our part to promote the cause we have labored to aid through its years of infancy.

Let the good words go forth—pull together—sit tight! Radio is now passing through a period of casual interest and enthusiasm. It will take its place as a dignified institution founded on conservative business principles because it is meeting a universal need. It is the cause to which I have personally pledged my support because I know its possibilities are unlimited.

Ralph S. Drummond

President

MEMBER A. I. E. E. & I. R. E.

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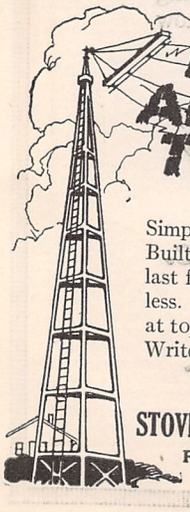

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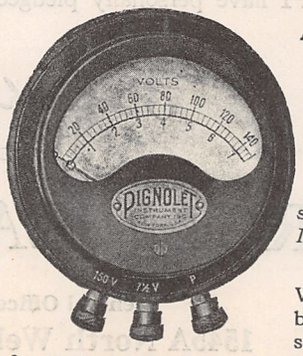

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are small microphones which are mounted on stands so that they may be placed in the best position for the particular selection to be broadcasted. These microphones have been very carefully designed so that the true tone qualities of music, voice, etc., will be clearly reproduced. The minute electric currents set up in the microphones are then transferred to the apparatus room, where they pass into amplifiers. Various controls are provided on these amplifiers so that the intensity of the transmitted selection may be varied at will. There is then available at the output terminals of the last amplifier a fairly strong electric current that varies in exact accordance with the sound waves impressed on the microphone in the studio. This current is next transmitted over a pair of wires to the modulator tubes located in the transmitting station proper. These modulator tubes are so connected that they may control the antenna current by varying the plate potential impressed on the oscillator tubes. Consequently we have a system of modulation that enables comparatively feeble sound vibrations to control or mould large amounts of radio frequency energy.

The censorship and supervision that are exercised by the men in charge of the broadcasting equipment are of some interest. The studio director has at his disposal a control switch that cuts the microphones in or out of the circuit. As soon as this switch is closed, a red lamp is illuminated which warns those in the room that everything spoken will be transmitted to the invisible audience. The "censor" or man in charge of the amplifiers in the apparatus room listens continually to the concert or selection being broadcasted so that he may make any adjustments necessary to improve the tone quality of the transmission. The censor is also in telephone communication with the transmitting station, where a constant watch is kept on the operator of the transmitting equipment, who in turn keeps a constant watch on his apparatus and by means of an oscillograph can determine the amount of modulation that is taking place in the antenna circuit. All circuit adjustments are, however, under the complete control of the censor and no changes are made without his consent.

Nauen Improves Radio Station

(*Continued from page* 436)

Hitherto Nauen has prided itself on one of the best equipped stations in the world. Its powerful buildings, massive erections with square towers, more like a fortress than a wireless station, were built during the war, evidently with an eye to future extension, though it was not then realized that the future purpose of Nauen would be to replace the lost cables to America. In the main machine hall are three great high frequency transformers, two of 1,000 horse-power and one of 300 horse-power. The present senders, ranging from 130 kilowatts to 400 kilowatts, are to be reconstructed and extended, and a number of automatic senders, deriving their power as by-products from the high-frequency machines of the main series, are to be put in for the European traffic.

Since the war the scientists at Nauen have been at work on various branches of research, most of which have yielded practical contributions to the service. Amplifiers and devices for selection have gone far to improve the capacity of the plant, though these are common to stations in and out of Germany. Considerable advance has lately been made in the adaptation of wireless to high speed telegraph machinery. The phonographic

method has given way to the Morse printer, and messages at the rate of 180 words a minute are received in Morse through the 400 kilowatt plant on the high speed Morse printer (similar to the Wheatstone machine from the American station at Marion, which is Nauen's "opposite number"), and with which it is in permanent (night) duplex working, with two centers at each end.

Good results have been achieved with the Siemens high speed type printer, though not over very long distances. A branch of experiment to which great attention is being paid at Nauen is that of wireless telephony. A year ago a distance of 4,340 kilometers (2,697 miles) was covered, equal to the distance from Nauen to St. John's, Newfoundland. Since then this distance has been exceeded, but so far no details of the latest experiment have been made public.

Senatore Marconi Entertained

(*Continued from page* 434)

gations and predicted new and greater fields for the extension of radio communication. The freedom of the city was tendered by Mayor Lunn and a brief address of welcome was given by Consul Bacelli.

In responding to the toast, Marconi spoke of the influence which radio is having, and is destined to have on the world's human relations by facilitating communication between nations and between peoples of the world, and the infinite future possibilities of the art of wireless as new knowledge of this strange and little understood phenomena begins to be known.

Marconi's experiments in short and long wave radio transmission were touched on with the prediction that the feat of encircling the globe by wireless was a possibility in the not distant future.

Announcer A. C. N. Tells Some Interesting Anecdotes

(*Continued from page* 424)

after Mme. Lipkowska sang, a letter came to us from the wilds of Canada, and I'll try to tell you exactly what it said. It read like this:

"'About eight o'clock on the evening of January 4th, which up in this wild region seems like midnight, my two dogs who inhabit the cabin with me raised their ears and appeared alert, as dogs in the city do when some one is approaching. I knew by the storm of wind and snow which was howling without that neither my partner nor anyone else could reach me from the town below. I was at a loss to account for their actions, until it dawned on me that the radio receivers on the table across the room might be the cause of their unrest. I hastened to pick them up, and as I did so I heard the voice of a woman in the final notes of a song. I waited and in a few seconds the voice of the announcer said:

"'This is Station WJZ, Newark, N. J., Announcer ACN; Madame Lydia Lipkowska, of the Imperial Grand Opera of Petrograd, will now sing an aria from Rimsky-Korsakoff's opera of Snegouretcka, or, translated, the Snow Maiden.'

"'Then Mme. Lipkowska came on the radio and her speaking voice was a wonder in

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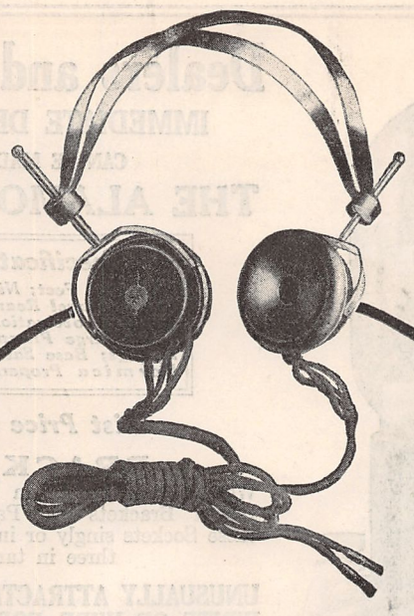
Look for it— It is your protection.



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The Manhattan Radio Headset is not just "another" headset on the market, but a product designed and built by one of the oldest radio manufacturers. Only in the higher priced instruments do you get the same supersensitiveness, the same amplifying qualities and the same freedom from distortion that are found in Manhattan Radio Telephone Headsets; and at a price within reach of all amateurs.

Manhattan Radio Telephone Headsets are on sale by all reliable radio dealers. If he hasn't them in stock he will get them for you.

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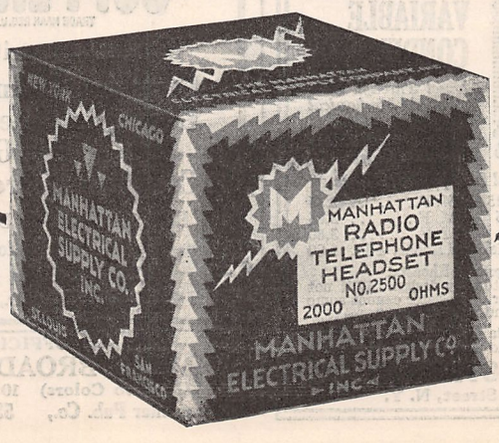

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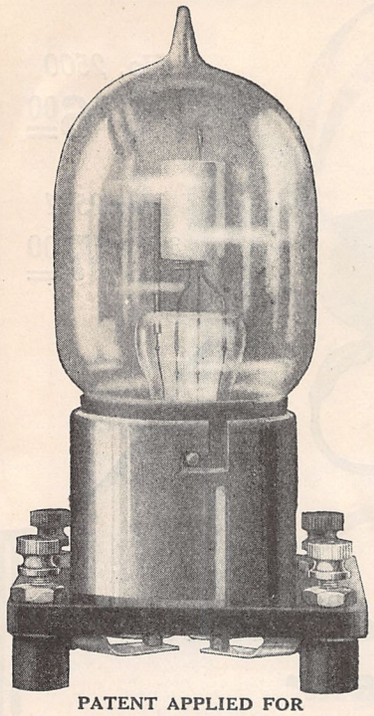

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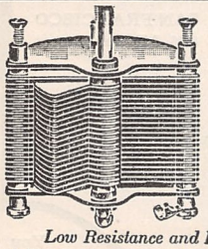

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transmission. With a delightful accent she explained the relation of the aria to the opera, and then sang it in Russian. I sat back and closed my eyes, and in the wilds of Canada, with the wind and storm howling without, and more atmosphere than any manager could ever produce on Broadway, I listened to the aria of the Snow Maiden. It was a real thrill to me. I am absolutely at a loss to put into words my sensations at such a unique experience. I hope you receive this letter in which I have tried to paint the picture as well as I am able.'"

I felt that any story would be an anti-climax after that one, so I left Mr. Cowan and went into the studio to hear a famous tenor broadcast the "Figaro" song from the "Barber of Seville."

Static Eliminator

(*Continued from page* 426)

binding post. This break avoids interference from disturbing eddy currents. The ring is merely large enough to slip snugly over the wired tube. The coil is pivoted to swing to any angle in the vertical plane. A dial on the base of the framework indicates the compass direction of the tube. Another dial, facing the operator, reflects the degree of elevation.

A "resonance wave coil" of the dimensions indicated is capable of receiving signals ranging upward to a wave-length of 1,200 meters. Contrary to the operating principle of former designs of tuning coils, the shortest wave point on this device is at the center of the coil. If the tube is in a position exactly at right angles to incoming electromagnetic waves, the brass ring may be moved toward either end of the coil as a means of tuning to the incoming signals. Putting it differently there are two points along the coil, located at equal distances from its center toward either end, where 600-meter wave-lengths will be audible. By the same token, at two points a bit farther along on both ends of the coil, 750-meter wave-lengths may be received. When the tube was located in the Washington laboratories of the Signal Corps, wireless signals from the radio telegraph station of the United States Navy Department in Cuba could be heard distinctly. The reduction of static electricity to a minimum by the use of the "resonance wave coil" inspired the Signal Corps to apply the principles of this device to the development of the "static eliminator," discussed in the preceding paragraphs of this article.

About Radio Magazines

(*Continued from page* 426)

Dealers	10.00
Telegraph senders	10.00
Telegraph receivers	5.00
Telephone receivers	3.00
Amateurs	2.00

Anyone gullible enough to send in this amount will receive a neatly engraved certificate, stating that he has joined the new Radio Institution; but the "nigger in the wood pile" is that all members are required to subscribe to a new radio magazine, which will be established "shortly." So the society to be formed is simply the bait to start still another new radio publication.

When it is remembered that even the smallest publications have to spend anywhere from $20,000 to $30,000 and upward and years of time and labor before they become established, the poor investors or "members" can just about imagine what their money will do for them.

We are giving this warning to our readers for what it is worth. "A word to the wise is sufficient."

Most Serviceable Government Radio Station in the World

(*Continued from page* 425)

casted over a large area of the United States. By the use of this powerful radiotelephone, when events justify its services, speeches of notable officials in Washington may be flung to the Middle Western States and as far south as New Orleans. The audible range may be conservatively expressed in terms of 1,500 miles' radius of the National Capital.

The radiotelegraph station of the United States Navy Department at Arlington, in structural design, happily combines the old with the new. It was the first high-power unit in the chain of stations erected by this Government department, having been built in the early months of 1913. While the progress of radio engineering in recent years has dictated a departure in some particulars from the structural plans obtaining nine years ago, yet the Arlington station has served as a pattern for high-power units subsequently built by the Navy Department. The towers at Radio, Va., are of the self-supporting, four-leg design, while sky-climbing frameworks of later construction have been deprived of one of their legs—being of the three-unit design, to be exact. The towers of "NAA" are spaced only 350′ apart, while later structural plans have decreed a spacing of 1,000′ or more. The Arlington towers are three in number, one 600′ high, while the other two are 450′ tall. They were designed to withstand a tug of 10,000 pounds at the top, whereas modern designs are capable of undergoing a pull of 600,000 pounds at their zenith.

The Potomac Electric Power Co., a local concern, is the source of electric current for the operation of the high-power wireless unit at Radio, Va. The supply enters the radio-transmitting quarters at a capacity of 6,600 volts, but this potential electric strength is stepped down to 220 volts for the purpose indicated. The original spark set, installed nearly ten years ago, continues in service, this unit being employed in broadcasting time and weather signals. The dissemination of market reports and weather information, an innovation recently undertaken, will be an additional burden devolving upon this time-honored transmitter. When this article is being written—June 20, 1922—several auxiliary antennæ are being erected at Arlington as a means of facilitating the handling of traffic of the Signal Corps of the United States Army from this point. Two 200′ towers, formerly in use at the Washington Barracks, and purchased by the War Department, are being converted into the needs of increasing the antennæ efficiency at Arlington, a burden that is being constantly multiplied by the joint uses of the Navy Department and the United States Army.

Radio, Va., the post-office address of the "Most Serviceable Government Radio Station in the World," to repeat the title of this article, is located four miles from the National Capital, in a southwesterly direction. Two buildings serve as quarters for the radiotelegraph and telephone apparatus, while a third structure is an administration building. This last unit is headquarters for the officer in charge and his six assistants. Strange to say, this wireless station does not receive radio communications. Remote control from the Bureau of Engineering, with headquarters in the Navy Department building, four miles removed from Arlington, makes possible a

"Stop those back fence concerts"

THE yowls of a prowling Tommy are as mere love-songs beside the ear-splitting howls of a perturbed radio set (and you'll be surprised how often one gets perturbed without the calming influence of the proper Amplifying Transformer).

Most any transformer can amplify sound, but it will also amplify the stray fields which produce howling and distortion. It takes the Acme Amplifying Transformer with its specially constructed iron core and coil to put an end to the "back-fence" concerts. Only when you add the Acme do you get the realistic tone and volume so markedly absent in the ordinary radio receiving set.

The Acme Radio Frequency Transformer greatly increases the range of any receiving set, either vacuum tube or crystal detector type. The Acme Audio Frequency Transformer produces not only volume, but reality of tone. It is indispensable to the satisfactory operation of loud speaking devices. The combination of one or more stages of Acme Radio and Audio Frequency Transformers assures the maximum of range, of volume and of reality in tone.

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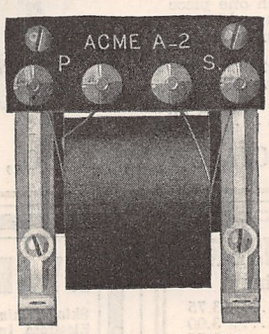

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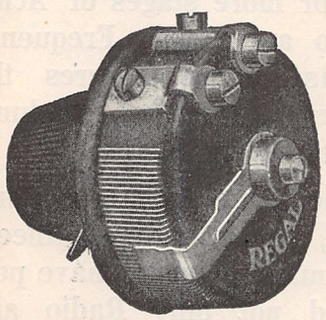

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23 plate	3.50
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"Regal" Inductance Switch and Dial

A quality instrument that is 100 per cent. efficient. 15-point switch complete in 1 unit. Does away with usual awkward and unsightly job of single threaded switch points bolted to panel. Requires but one hole to mount on panel. Smooth wiping contact over heads machined to same height on one piece contacts. Complete soldered assembly attached, or removed from panel by means of one threaded shaft bushing. Gives inductance regulation by dial contact. **THE BIGGEST HIT IN RADIO.** Complete with Knob and Dial.

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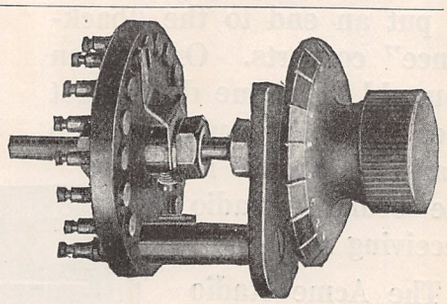

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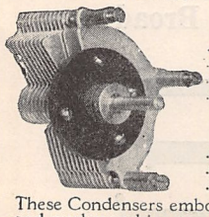
11 Plate .00025 Mfd.	2.75
3 Plate Vernier	1.25



Square Law Type

.0005 Mfd.	$3.50
.00075 Mfd.	4.50
.001 Mfd.	5.50
.0015 Mfd.	6.50

Balanced Type

.001 Mfd.	$5.50
.0005 Mfd.	4.75
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These Condensers embody the best materials and workmanship, are extremely efficient and for beauty of appearance are unsurpassed.

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HYGRADE SPECIALS

Skindervikin Transmitter Buttons	$0.75
Electrose Insulators (per dozen)	2.00
Binding Posts (Rubber Cap), per dozen	.75
7 Stranded Copper Aerial Wire, 100 feet	.60
1,000 ohm Elwood Wireless Phones	1.75
Signal Variable Condensers, 43 Plate, with dial and knob	4.50
Paragon Vacuum Tube Control Panels	5.50
Arkay Loud Speakers	3.89
Klosner Vernier Rheostats	1.25
Thorderson Amplifying Transformers	3.98
Acme Amplifying Transformers (mounted)	4.25
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6 Volt 30 Amp. Marko Storage Battery	10.00
6 Volt 60 Amp. Marko Storage Battery	13.50
6 Volt 80 Amp. Marko Storage Battery	17.00
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Above Prices Are F. O. B. New York

HYGRADE ELECTRICAL NOVELTY CO.

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system of continuous transmission and reception of messages—an arrangement which is said to be decidedly in the interest of efficiency. Operation of "NAA" is on a twenty-four-hour basis. Joint operation by the Navy and Army branches of the Federal Government obviates the expense of separate stations. Visitors to the National Capital, who are desirous of seeing in actual operation the most widely known radiotelegraph station in the country are required to obtain special permits from the Radio Division of the Bureau of Engineering, United States Navy Department.

Newspapers and Radio

(*Continued from page* 423)

quency amplifier, two-stage type A.A., style 307–207; Hatfield battery cabinet, a two-step amplifier type triode B, serial No. 103, made by a radio company of Boston; three load coils; a flock of "A" and "B" batteries, a specially built battery charger with switchboard arrangement and seven large Western Electric and Magnavox receiver phones, with again as much material not yet hooked up for use.

Two years ago, when the world at large knew practically nothing about wireless, the *Tribune* operated its own wireless station on the roof of the plant at Madison and Dearborn Streets. Now most of their wireless dispatches are relayed over land lines from Halifax, or New York. Because of its foreign edition at Paris, and its many foreign correspondents, no doubt is expressed but what the *Tribune* will soon be prepared for national and international wireless exchange second to no American newspaper.

The *Tribune's* interest in wireless dates from the time when the first experiments in radiotelegraphy in the Middle West were made, under the auspices of that newspaper, following the announcement of Marconi to the world that wireless communication was possible. At the invitation of the *Tribune*, Jerome J. Green, professor of physics at Notre Dame, visited Chicago to aid in conducting a number of experiments. Aerials, the first ever seen in the Middle West, were erected on the tallest building and the *Tribune* personnel went out on the lake with a receiving apparatus. The experiments were successful and attracted wide attention, and though the equipment was primitive, the wide possibilities of wireless, and the truth of Marconi's discovery were then and there demonstrated. It was said that Notre Dame was the first educational institution in the United States to prove the value of Marconi's discovery.

Radio Broadcasting and the Department Store

(*Continued from page* 423)

the Hecht Company, in expressing himself to the writer, said he would adhere to a broadcasting service that will partake of both entertaining and educational features. The program will not be lopsided; rather, balance will be sought in serving a diverse citizenry, which the resources of the modern department store typify. Music, both vocal and instrumental, will be broadcasted. This popular feature, however, will not overshadow offerings pertaining to subjects more prosaic. Lectures on health, education, civics and

other topics aiming to elevate and instruct the mind will make for diversification and interest in the broadcasting service of a mercantile establishment whose type exists and thrives by reason of a diversity of merchandise.

Radio Broadcasting in Great Britain

(*Continued from page* 422)

The hours of 5 to 11 P. M. are the ones during which broadcasting will be effected on weekdays, the whole of Sunday being free.

There is no doubt whatever that Great Britain is going to take the fullest advantage of American experience. It is proposed to start straight and avoid the troubles which America is experiencing through overcrowding of the ether. No advertising of any kind will be allowed and no transmission of messages will be permitted which would interfere with the revenue of the State-owned telegraph and telephone system. Broadcasting stations, moreover, will have to keep up to a high standard of quality in their transmissions, or their licenses to work will be suspended. The most stringent steps will be taken to prevent interference with broadcasting programs which will thus very greatly benefit by State protection of this kind. It seems likely that no regenerative circuits will be allowed, in view of the great interference they cause if they oscillate.

Those desiring to receive broadcast messages have to hold a license, this license costing 10/- per annum. This fee is intended to cover Government expenses in connection with the supervision of the scheme.

The demand for technical instruction has been phenomenal. The newspapers all have series of articles on radio telephony and numerous books are being published on the subject. The sales of two of the present writer's books (one of them, "Elementary Text-book on Wireless Vacuum Tubes," being written solely for the American amateur) during the last three weeks has reached nearly 60,000. As regards radio journals, there are four in number, whereas a couple of months ago there was only one. This will give some idea of the unprecedented thirst for information. The demand for apparatus is also unprecedented. All the small companies engaged in making amateur wireless apparatus have increased their capital and already have orders booked up for several months ahead. New factories are being built and practically a new industry has been started.

Those holding important patent rights are naturally wondering how they can benefit by the huge sales of modern apparatus. There is the likelihood of a number of patent actions in the near future. No licenses under any patents are being given and this considerably aggravates the position. Fortunately there are no master patents on vacuum tubes in Great Britain, the position in this respect differing from that in the United States.

NUMBER OF FIRMS ENGAGED

The total number of firms which are engaged in the supply of radio apparatus is at present about fifteen, but every day some new company is started to produce radio apparatus in readiness for the great boom which is inevitable and which will commence in earnest as soon as the broadcasting radio stations commence work.

At present the only broadcasting which is done is a weekly entertainment lasting nearly half an hour. In addition to this, entertainments which are known as the "Dutch Concerts" are received. These are sent out by an enterprising Dutch manufacturer at The Hague, who sends music for about two hours every Sunday afternoon. These were the first regular broadcast concerts received by the British amateur, and although the signals received have always been comparatively weak, yet the popularity of the concerts has been extraordinary, although when proper broadcast stations are erected, the

Burgess, the Radio Battery

—Not a Group of Flashlight Cells

Burgess "B," the *Radio* Battery, has been manufactured for wireless use since the infancy of radio. Burgess "B" Batteries never have been, nor are they now, merely assemblies of flashlight cells.

Burgess "B" Batteries were designed by radio experts for exclusive radio use, and these radio features are fully patented. You will find this special *radio* construction in Burgess "B" Batteries *only*.

Burgess "B" Batteries are handled by all progressive radio jobbers and dealers. "Look for the Black and White Stripes." And if you can't get the Burgess "B" from your dealer, just address (Dept. C)

BURGESS BATTERY COMPANY

Manufacturers of

Flashlight, Ignition and Telephone Batteries

Offices and Warehouses at:

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In Canada: BURGESS BATTERIES, Ltd.
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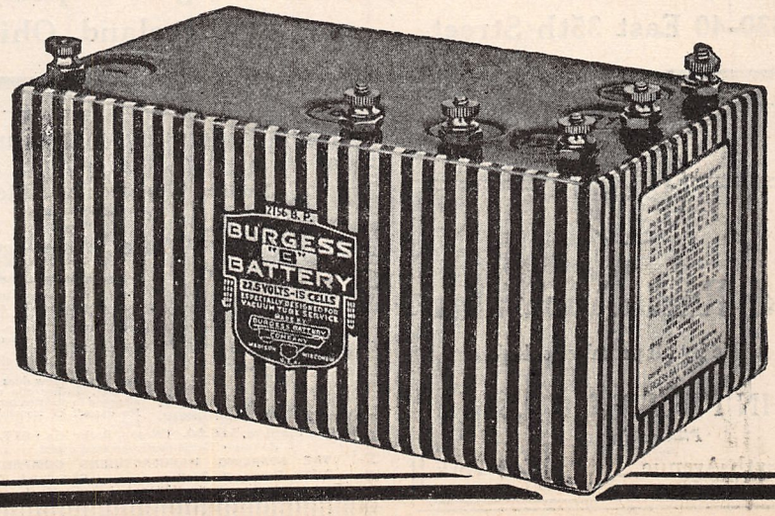
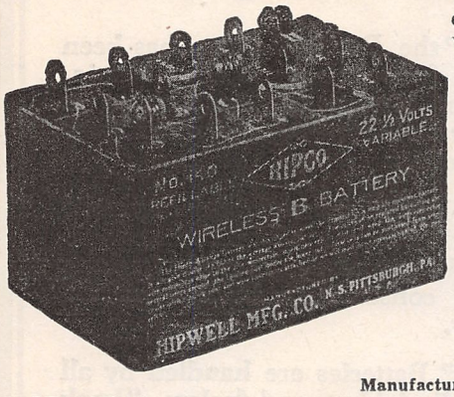
BURGESS "B" BATTERIES

"ASK ANY RADIO ENGINEER"





Buy a Hipco Multiphone

Price $5.00 Complete With Four Sets of Head Phones

Let Your Friends and Family Listen in—Reproduction 100% Perfect. No Trouble—Nothing to Get Out of Order.

The Hipco Multiphone enables you to purchase four pair of receivers for less than the price of one. Reproduction 100% perfect—no trouble—absolutely nothing to get out of order. Your family or your friends may now enjoy radio concerts, lectures, etc., with perfect ease and comfort to all.

The Multiphone may be used in connection with any receiver. Simply place one of your receivers face down on Hipco Multiphone and draw the elastic bands over back of receiver to hold it firmly. The Multiphone will do the rest in a most pleasing manner.

HIPCO WIRELESS B BATTERY

	Refillable Variable
No. 140—22½ Volts, Price.....	$2.00
No. 100—22½ Volts, Price.....	$3.00

FOR SALE AT ALL RADIO SUPPLY DEALERS

Manufactured by

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IF IT'S { *NEW* *ORIGINAL* *BETTER*

Mazda Radio Makes It

Variable Condensers
2,000, 3,000, and 4,000 Ohm Head Sets
Amplifying Transformers
Jacks
Plugs
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and other necessary accessories

Absolute Guarantee of Quality. Very Attractive Prices

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Firco Radio Apparatus

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Pioneers since 1901
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The Sterling Portable Rectifier

It is not necessary to lug your battery to a service station. Rectifier charges your battery from any A. C. lamp socket without its being disconnected from Radio outfit. Mechanism simple, effective and durable. One thumbscrew does all adjusting. Either clip can be attached to positive terminal. No danger of injuring battery.

Initial charging rate 6 volt battery either 5 or 10 amps.

Price complete, **$16.00.** (West of Rocky Mts.) **$17.00**
Ask your Radio dealer or send direct
THE STERLING MANUFACTURING COMPANY
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Over two million Sterling Electrical Devices in use today

Dutch concerts will become a thing of the past. Nevertheless, the endeavors of British amateurs to receive these Dutch concerts in different parts of the country have resulted in the perfection of radio-receiving apparatus.

The classes of circuits used by the British amateur appear to be very much more varied than those of American amateurs. The British amateur is rarely satisfied with a single stage regenerative receiver. He nearly always employs several stages of radio-frequency amplification, the circuits between the tubes consisting of radio-frequency transformers or circuits tuned to the incoming wave-length. In a country where all signals are comparatively strong, the use of many stages of amplification would not be necessary, but in Great Britain the development of multistage receiving circuits has attained great popularity.

The number of transmitting stations is still very small and the maximum power allowed is only 10 watts. This no doubt is preferable to experiencing a great deal of interference.

THE FUTURE OF BROADCASTING

When broadcasting is in full swing, its manifold uses will no doubt be taken advantage of. At present the use of the broadcasting stations will be chiefly for the purpose of entertainment. Later, no doubt, they will be largely used for disseminating news items. Already both the Radio Communication Company and the Marconi Company have broadcasted the news of the Carpentier and Kid Lewis fight. The report of the fight was broadcasted in much the same way as the news of the Dempsey-Carpentier fight was distributed by radio telephone in America. The Radio Communication Company actually broadcasted Dempsey's own report of the fight between Carpentier and Kid Lewis. Market reports, weather warnings and other useful items will no doubt form part of the program of the radio broadcasting stations.

Much information, both of a technical and general character, is at present being obtained from America and the British stations will undoubtedly be run on very similar lines to those in the States, although much greater care will be exercised in lessening troubles due to interference which would undoubtedly in a very short time kill popular interest in the subject.

COST OF SETS

The cost of the radio sets will vary between about £4 ($19.20) and £50 ($220.00). The crystal receiver sets, of course, will sell at about £4, and will be suitable for the reception of broadcast signals from a near-by station. The more expensive sets will consist of vacuum tube receivers, probably using two tubes. For longer distances several tubes will be employed and loud-speaking apparatus will be used for enabling the speech and music to be heard without the aid of telephone receivers.

The problems connected with the provision of filament and anode batteries have not yet been solved. What is required, no doubt, is a vacuum tube which will work off dry cells. One type of such a vacuum tube has already been produced, but has not reached a sufficiently high stage of perfection to be placed on the market at a reasonable price.

Consideration is also being given to the use of electric light mains for supplying the necessary current for vacuum tube apparatus.

At the present time ordinary amateur apparatus is being supplied to the general public, but all the large firms are beginning to design specially simple apparatus which could be easily worked by the general public.

There is not the least doubt that within a month or two Great Britain will be in a state of radio enthusiasm comparable to that at present existing in the United States.

DID YOU KNOW THAT?—

The call letters of the Police Station at Detroit happen to be KOP.

By A. J. De Long

The Chicago Radio Show

(*Continued from page* 428)

outfits. These are built in so-called radio laboratories, but just as being born in a stable does not make one a horse, much of this apparatus called radio-receiving outfits fails to receive.

"Radio is fast becoming a part of American home life, and when a large percentage of American homes are fitted with radio outfits, a great public demand will have been created for broadcasting. This demand will make itself felt in a political manner and it is conceivable that mayors and governors may be elected because they gave the public better broadcasting than their predecessors."

Woman's place in the field of radio was discussed by Miss Elizabeth A. Bergson, radio instructor at Lane Technical High School.

"As science advances and the industry itself grows, woman will take a more important part just as she is now doing in all other branches of commercial endeavor," said Miss Bergson in addressing the convention.

"The first appeal of radio to woman is the receiving set, listening in to music—the artistic side of it. As a mother she is interested because these radio concerts and dance music received through the home-receiving set have a tendency to keep her sons and daughters home evenings.

"When this interest dies out, woman will turn to the commercial side, and in that I see for her great possibilities. Woman can reach any goal in the radio field. New York has a woman ship inspector who inspects all the radio apparatus before the ships sail. On Lake Erie there is a woman wireless operator, but the law, 'women first' in case of accidents, for the present at least, eliminates women from the high seas wireless service."

Undoubtedly something constructive has been accomplished by the show. Manufacturers, jobbers, retailers, amateurs, professionals, and the public have been thrown together to derive many benefits that at first may not be readily discernible. Wide publicity was given the show, a sixteen-page booklet being mailed to 15,341 radio supply dealers, 904 manufacturers and 736 jobbers.

Then possibly new Edisons have matriculated, another Marconi has been developed, by the spirited contests and interchange of views.

Practical C. W. Design Data

(*Continued from page* 441)

at the desired wave-length. The adjustment of a tube set is more or less of a mystery to many experimenters, but the general characteristics of this type of circuit are as follows:

The variable contact A determines the wave-length at which the circuit will oscillate. The voltage built up between A and B supplies the necessary grid excitation. For operation with a high resistance antenna more grid voltage is required, therefore a greater number of turns must be included between A and B. In order to secure good operation the plate impedance must equal the antenna impedance. This condition is obtained by adjusting the turns included between B and C.

Radio panels and Radio Parts

Start right. The panel is the very foundation of your set. High volume and surface resistance are essential factors. Make sure that you get them in both the panel and parts that you purchase. To make doubly certain look for the dealer displaying this sign:

CONDENSITE CELORON

Radio Panel Service

Condensite Celoron Grade 10—approved by the Navy Department Bureau of Engineering—is a strong, handsome, waterproof material, high in resistivity and dielectric strength. It machines easily, engraves without feathering and is particularly desirable for panels. It is also widely used for making many other important radio parts, such as tube bases, platform mountings, variable condenser ends, tubes for coil winding, bases, dials, knobs, bushings, etc. We are prepared to make these various parts to your own specifications.

Where economy is a factor we can supply panels of Vulcanized Fibre Veneer made of hard grey fibre, veneered both sides with a waterproof, phenolic condensation product. This material has a hard, smooth, jet-black surface, machines and engraves readily and will give excellent service where very high voltages at radio frequencies are not involved.

Shielded plates (patent applied for) are made with a concealed wire shield. This shield, when properly grounded, effectively neutralizes all howl and detuning effects caused by body capacities.

Send today for our Radio Panel Guide

Are you an enthusiast? This Guide describes our panels in detail—gives tests—and tells just how much the panel you want will cost.

Are you a Radio Dealer? Let us tell you how easily and profitably Celoron Radio Panel Service enables you to supply your customers with panels machined and engraved to their specifications. Write today for our Dealer's proposition covering panels, dials, knobs and tubes.

Diamond State Fibre Company

Bridgeport (near Philadelphia), Pa.

Branch Factory and Warehouse, Chicago

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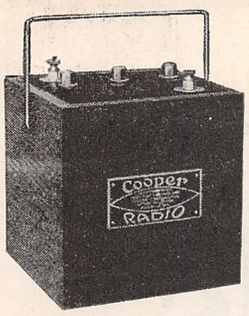

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RADIO BATTERIES

Specially designed for Radio Use

6 volt	40	Ampere	Hours
6 "	60	"	"
6 "	80	"	"
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6 "	150	"	"

If your local dealer does not handle Cooper Batteries, write us for nearest distributing point.

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Rub-Mika, the ideal material for panels, rotors, knobs, dials, sockets, handles and other parts for radio and electrical equipment. Rub-Mika is not affected by atmospheric changes; does not warp, shrink, expand, check or crack. A perfect non-conductor. Costs less than other materials used for similar purposes. Send us samples or blue prints of your parts and let us quote you prices.

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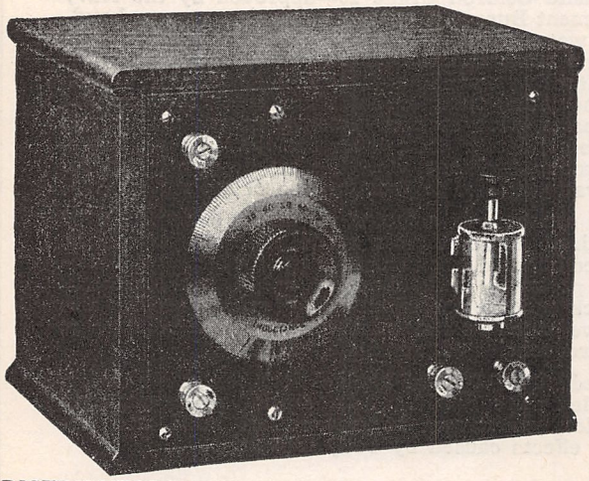

PHONES

2000 OHM
$6.00 List

3000 OHM
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DISTRIBUTORS AND DEALERS! We have a proposition that will net you big returns. Get in touch with us today.

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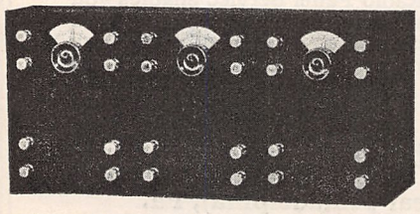

Detector and Two-Stage Amplifier } $22.50
Detector Panel and Cabinet - - $5.50
(Less batteries and tubes)
2000 Ohm Receivers, $5.00
Superior Crystal Receiving Set, $4.75
Attractive dealers' proposition
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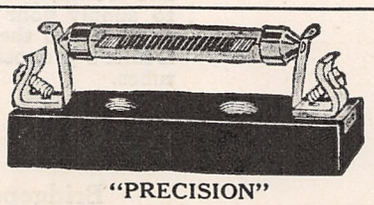

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It will be observed that bringing B nearer A increases the plate inductance, but decreases the grid inductance. At all times the three variables should occupy the same relative positions as shown. In other words B must connect to some turn of the coil between A and C. This makes the plate and grid radio frequency voltages 180 degrees out of phase, which is necessary for oscillation in any vacuum tube circuit.

The amount of current obtained in the antenna will, of course, depend largely upon the radiation resistance. This set will radiate from 1 to 1.75 amperes with the average amateur antenna. The power input into the tubes can be roughly determined by the color of the plates. These should not run hotter than a dull red if long tube life is desired.

Fig. 1 shows the key and chopper in series with the grid leak resistance. This is the best manner in which to control a tube set for telegraphy as the natural characteristics of the grid are utilized. The action taking place may be described as follows: Under normal conditions with the tubes oscillating, a certain value of negative potential is maintained on the grids because of the voltage drop across the grid leak. Since the leak is shunted around the grid condenser, this condenser cannot hold a charge and the tubes oscillate about a favorable part of their characteristic curve. Now, if we open the grid leak circuit with the key or chopper, the grid condenser immediately accumulates a negative charge which shuts off the plate current, and the antenna output therefore drops to zero.

The chopper is simply a device for opening and closing the grid leak circuit at an audio frequency, thus making I.C.W. telegraphy possible, which can be received without a heterodyne receiver. Using a properly designed chopper the tubes will draw approximately one half their C.W. value of plate current, unless readjustments are made. Therefore while the average value of plate current may be the same, it is possible to so adjust the transmitter that the peak value is twice its normal amount. This in turn results in a considerable increase in the peak antenna current which, while not indicated on the antenna ammeter, is very effective in securing maximum range. Consequently we have a combination that permits us to increase the output of our transmitter without overloading the tubes, as the practical limitation in a tube set is the energy dissipated as heat in the plates. When the plates reach too high a temperature, gas is generally given off, causing the familiar blue glow which may destroy the tube.

In conclusion, it might be stated that a vacuum tube set built as described will give good results and in range obtained will out-perform many spark transmitters requiring two or three times the power input.

A Better Method of Winding Honeycomb Coils

(*Continued from page* 458)

The diagram shows how this is accomplished by taking a turn around two of the pins instead of one, as is the usual practice.

Start the winding in this manner and lead the wire around the 11th and 12th pins on the opposite side, then back to the 23d and 24th pins on the first side, then to the 10th and 11th pins on the opposite side, then back to the 22d and 23d pins on the first side, and so on.

After the first layer is wound it may be readily seen that an exact duplicate of the machine wound coil is obtained.

Contributed by EDWARD JOHNSON.

Radiogeoscopy

(*Continued from page 438*)

apparatus used, the results of the examination would not be sure, and it was decided to try the Hertzian method. The detector was placed in R″ at the extreme end of the third drift, and the exciter was placed at T″, near the entrance of the excavation. The operator placed at R″ could determine exactly the lay of the deposit. He then gave orders to the operator in charge of the exciter to carry it to T1, and found that on the new line there was no mineral mass.

The test was repeated, placing the exciter in T, and with the same result when the exciter was placed in R″ and the discharge tested toward R.

He then took the exciter into the shaft below to its extreme end and found that emissions from T were received, while those from T″ were not received. The experiments were then repeated, taking the exciter a good distance to the right of T and changing positions in the direction normal to the line T″, T1, T. It was found that the propagation of the waves was not interfered with and that, therefore, there was no trace of mineralization in all the subterranean sections explored.

In Fig. 5 is shown a test directed to discover a mass of ore, the probability of whose existence followed from the vicinity of other metal-bearing deposits in an active mine whose plan is shown.

The Hertzian exciter was then placed at T, and the first experiment consisted of placing the detector at R″, in order to be sure that the quality of the mineral of the known deposit was such as to make a screen along the way. Having determined this fact, the operator at R″ moved along slowly, following the drift toward R‴, at which position he began to catch the waves and thus establish the line of contact of the bed being explored. Continuing to go on toward T, the operator employed a positive knowledge that all the region between the drift and the deposit was sterile.

The operator then went to R′ and followed along the drift between the same deposit, which was without mineral. Finally the operator covered the whole gallery, which was dug in sterile ground in the direction of R⁗, and having thus got to its end, found the sound had ceased, which proved that there was a new deposit in the line explored.

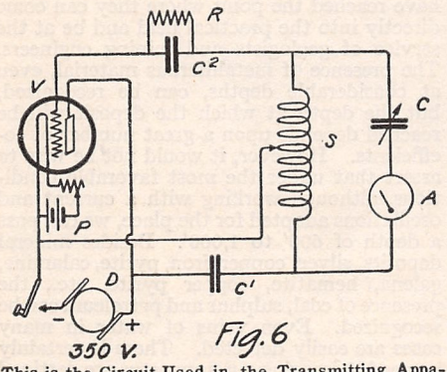


Fig. 6

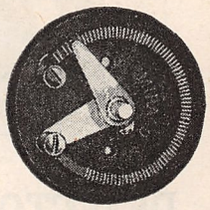
This is the Circuit Used in the Transmitting Apparatus to Locate Minerals. The Coil S is 8″ in Diameter. There is no Aerial.

The apparatus used for radiogeoscopy are an exciter or emitter of waves and a detector, or as we have hitherto called it, the oscillator. The exciter is comprised of a D. C. current generator, giving 320 volts potential, which may be a little dynamo apparatus on a wheeled platform or a battery of small accumulators, and an oscillator with three valves in parallel. Fig. 6 shows the arrangement, and needs no further explanation.

The main characteristic of this apparatus is the absence of an aerial and of any ground

Some Additions To The Famous "Miraco" Line Of Radio Products

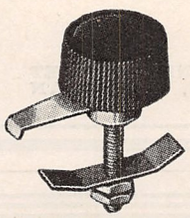
"Miraco" Panel Mounting Rheostat



Just a real good filament rheostat for smooth control of vacuum tubes. Base is of moulded insulation 2⅛″ diameter. Resistance is special non-corrosive alloy. Safely carries 1½ amperes. Resistance 6 ohms. A tapered knob and polished nickel-plated pointer make it better appearing than any other available..... **$0.90**

Better—Why Pay More?

"Miraco" Rotary Switch Lever



The new "Miraco" panel switch lever is an improvement over the old types, simple yet sturdy in construction. Tapered rubber knob, nickel-plated switch arm, 1″ radius... **$0.30**

"Miraco" Fixed Condensers

Correct capacity for use in receiving circuits.
Grid condenser .0005 mfd. with ½ megohm leak..... **$0.25**
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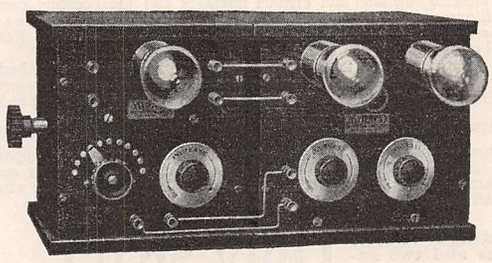
Better—Why Pay More?

"Miraco" Vacuum Tube Receiver and Two-Step Amplifier



Both units are of uniform height and depth and the binding posts arranged for short connection, giving a complete receiving set with two steps of amplification.

While the "Miraco" two-step amplifier was designed to match up uniformly with the well known "Miraco" Receiver it may be used of course in connection with any audion detector hook-up.

"Miraco" Vacuum Tube Radio Receiver (left) without phones, tube or batteries..... $18.00

"Miraco" Two-Step Amplifier (right) without tubes or batteries.... $25.00

The above combination without accessories, $43.00

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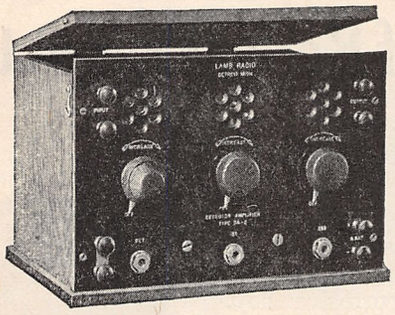

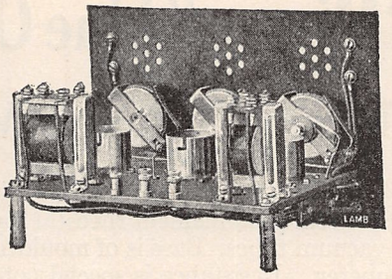

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Makes the Little Set Work Well and the Big Set Work Better

GIVES LOUDER, CLEARER SIGNALS, AND INCREASES RANGE

You cannot imagine how loud and distinct messages and broadcasting come in over the Amplitone until you have one yourself and verify the results in actual use. Antenna "frying," scraping and grinding noises are usually entirely eliminated. Nothing like Amplitone has ever been offered to you before.

Amplitone has much greater capacity than ordinary copper wire or similar makeshifts, because it is specially designed for radio use. Its flat, close woven form also affords the greatest possible conductivity to high frequency oscillations and brings in the signals without leakage.

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With the Amplitone you no longer need aerial spreaders and a lot of special apparatus to erect a receiving set. A single 75-ft. length of Amplitone put up in your attic or around the moulding of your spare room will give better results than any number of copper wires or other makeshifts strung on the roof. Try it out and prove it for yourself!

Shinn Amplitone Antenna, consisting of 75 feet, braided of ten pure copper wires and two antenna clamps, shipped for..... Only $6.00

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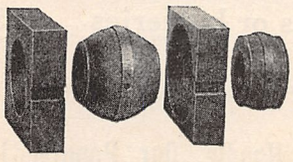

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connection, facilitating the disposition of the apparatus, giving it great mobility and making the explorations very easy. The radiating system consists of self-inductance of about 18″ diameter, wound around the box containing the audions, which is mounted on a tripod so as to be turned about as desired. The radiation of the waves can be produced in a desired direction. The whole thing is very easily transported on a Decauville cycle car, either on the surface or in the drifts, so that the work is made very easy.

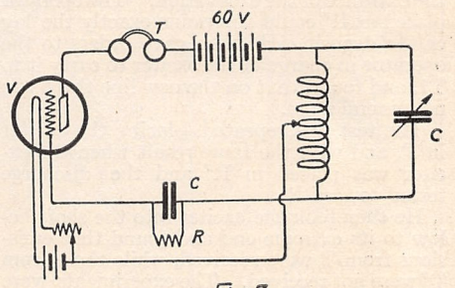


Fig. 7

Circuit Used in the Receiving Apparatus for Locating Minerals. The Inductance is Wound Round the Outside of the Box.

The entire detecting apparatus is shown in the diagram (Fig. 7). In this, too, the self-inductance is wound around the box, which last is carried by the operator, or placed on a tripod, while the anode and filament batteries are held by the assistant, or *vice versa*.

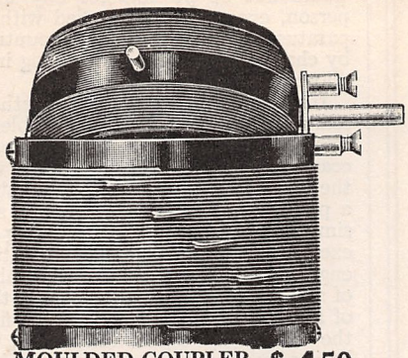
This explanation gives the fruit of studies and experiments carried out by various electricians during the last few years.

The writer has executed, and has had executed, laboratory tests and practical experiments in various localities with all the systems described in this paper, and particularly with the method of the Zone of Silence screen method, and with a high frequency method of Di Legge e Smalzi.

The technique of these electric tests is now considerably involved, and we are far in advance of the first attempts, with a magnetic means, of those of Schumberger with polarized electrodes, and even of the system called Swedish, the main drawback of which is that it requires too long a time to execute.

It is probable that in this field of work further perfections may develop when the propagation through the soil of electro-magnetic waves, and in particular of the diffusion of waves from a ground connection and at the feet of an aerial, will be better known. Electrogeoscopy and radiogeoscopy and technique have reached the point where they can come directly into the practical field and be at the service of geologists and mining engineers. The presence of metalliferous material, even at considerable depths, can be recognized, but the depth at which the deposit will be reached depends upon a great number of coefficients. However, it would not be wise to assert that under the most favorable conditions, although working with a current and oscillations adapted for the place, we can pass a depth of 600′ to 1,000′. Besides mineral deposits, silver, copper, iron, pyrite, calamine, galena, hematite, copper pyrite, etc., the presence of coal, sulphur and petroleum can be recognized. Even veins of water in many cases are easily detected. There is certainly no need to imagine our apparatus are destined to supplant the classic methods of geological deduction and of the mineralogical science, nor need we suppose that from now on our electricians will replace geologists and mining engineers. The systems and apparatus for electric discovery can only be of service in the hands of geologists and mining engineers as a complement and control of their deductive methods and of valuable integration of theory and of that sixth mineral sense possessed by experts familiar with subterranean explorations.

In their turn theory and experience have to serve as integration and control, and often as a basis for electrogeoscopic research. It



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GET THESE POINTS:

Bearings will not bind. All metal parts white nickeled. Rotor balls hard rubber and solid mahogany. Windings of green double cotton covered wire.

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Binding posts have large knurled thumbnut. Minimum clearance between rotor and stator. Mounts easily and is designed for low dielectric losses and maximum range of induction. All mahogany finish, wonderful appearance. Effective tuning range of 150 to 650 meters.

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Moulded hard rubber rotor ball. Primary windings on black polished fiber tube. Has nine taps for varied inductance. Easily installed. Will operate perfectly and give higest efficiency. Save money by using this cheaper and better equipment.

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HARD RUBBER VARIOMETERS. Green cotton covered wire, all parts white nickeled, rotor ball and stator forms all hard rubber. A beautiful product that will give results. EACH $5.00

11-plate Variable Condenser, assembled without dial	$3.25	Potentiometers	$1.50
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Audio Frequency Amplifying Transformers, ratio 3½ to 1	4.00	1-piece Moulded VT Socket, each	.75
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Vernier Rheostats	1.50	Small Knob Indicating Switch, each	.50
		Large Knob Indicating Switch, each	.50
		Contact points with nuts, each	.01½
		Contact stops with nuts	.01½
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Detector Unit in a very neat appearing black case, compact and easy to carry..... $65.00
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All above sets, except amplifying unit, include B battery, phones and tubes.

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1917-1918 PARAGON acknowledged supreme on Western Front.

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Manufacturers

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Low *dielectric losses*

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For panels and all radio parts. In sheets, rods and tubes, or machined to your specifications. Made by the original manufacturers of vulcanized fibre.

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Includes All Necessary Panel Mountings for a Complete Crystal Receiver

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18 Switch Points with Nut
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1 Detector Post, Universal Joint
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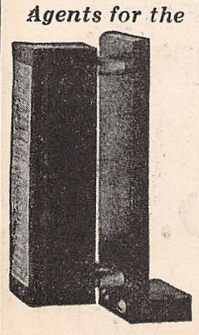
Agents for the
DX RADIO FREQUENCY TRANSFORMER



The secret of long distance reception. Ideal with coil aerial. Its superiority is well established. See p. 930, April-May, 1922, Radio News. Folder on principles of radio frequency amplification with pictorial diagram, 50c. Free with order.

DX 1-170- 450 meters, $8.00
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COLUMBIA RADIO SUPPLY CO.
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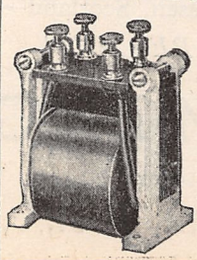
Thornton *Audio Frequency Amplifying* **Transformer**



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Write for particulars

Thornton Transformer Co., Inc.
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would not be possible for any unqualified person, even though supplied with new apparatus, to travel over any country chosen by chance looking for and finding iron in the plioscene or coal in the miocene.

In a special way the new method of research will serve to solve the problems of the mine; for example, where the mineralization ceases, the presence of an outcrop will cause the director of the works to be doubtful, and a problem of this kind cannot be solved by simple theory. Before undertaking extensive excavations and difficult explorations, the engineer will avail himself of the valuable aid of modern methods with which, in the course of a few hours, he will be able to find out if the vein begins again and where, what the limit of contact of a bed of ore is, if and how in a sterile mass a metalliferous body may exist and to give a varied and full quantity of valuable indications which will prevent error, false directions, useless labors and often very great expense.

In many cases a simple reason based on theory, or the simple discovery of an outcrop followed by well directed electric inspections will bring certainty to important discoveries made on the surface without the need of any excavation whatever.

At least in these first days of electrogeoscopy, recourse must often be had to operators specializing in the use of all and various means and systems, each of whom can be chosen for a particular case in which others may not be useful and each one can serve as a control on the other.

The use of one in preference to the other system is not recommended. All are efficient, but each is efficacious in some cases and explorers cannot do their work without a Wheatstone bridge for determining resistance, alternative for tracing lines as equi-potential for the direct location of zones of silence, then a high frequency generator, and then a system with vacuum tubes for determining the contours and limitations of screens used in all deposits.

The use of electrogeoscopic apparatus is advisable for specialized operators to carry on their work under direct supervision of geologists and mining engineers.

Only specialized operators who are familiar with the varying sounds of a telephone and have created their own tables of data, and carry in their memories numerous examples of former experiences, would be in a position to appreciate the sufficient approximation, the results of the experiments, and to make a correct calculation, especially of the depth of the deposit.

We will soon have a complete science embodying these researches with relative numerical coefficience and exact formulas, especially if care is taken by all who are interested in noting exactly the lessons taught by experience.

The Vacuum Tube as a Detector

(*Continued from page* 463)

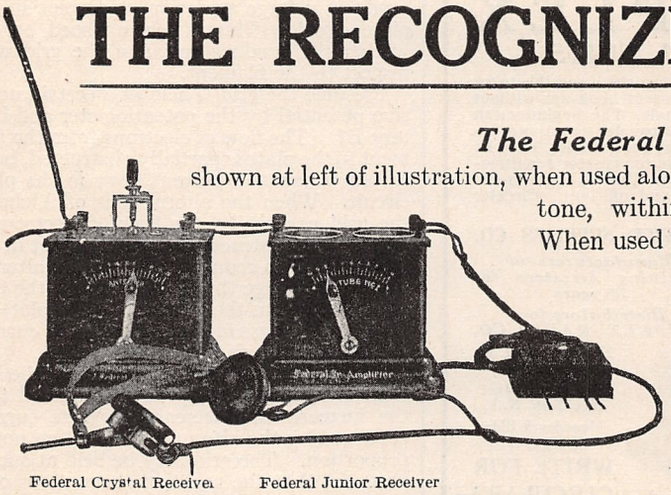
the potential of the grid is altered, these alterations are faithfully repeated in the increase or decrease of current in the plate circuit.

If a source of alternating current A is connected in the grid circuit, as shown in Fig. 4, the alternations of current will charge the grid with a positive and negative potential alternately. By means of the potentiometer, the grid may be held at a certain positive or negative potential with respect to the filament and the alternations of current produced by A will increase or decrease this potential. Thus if the grid is held at a negative potential with respect to the filament, the negative alternation of A will render the grid increasingly negative. The positive alternation of A will render the grid less negative; or if the E. M. F. of A is sufficiently high, it may cause the grid to possess a positive potential with respect to the filament.

Federal

RADIO APPARATUS

THE RECOGNIZED STANDARD



Federal Crystal Receiver Federal Junior Receiver

The Federal Crystal Radio Receiver

shown at left of illustration, when used alone will most efficiently receive, in a clear, soft, pleasant tone, within a radius of 25 miles from a broadcasting station. When used in connection with

The Federal Junior Amplifier

as illustrated, the range is increased to 100 miles.

While

The Federal Junior Amplifier

is designed for use with

The Federal Crystal Receiver

it works equally well with any type of Receiver using crystal or vacuum tube detector.

Demand Federal Radio Apparatus from your dealer

Write for Bulletin-No. 115-W

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BUFFALO, NEW YORK

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Over 50 pages of latest hook-ups (wiring diagrams) and invaluable and up-to-date data and information on radio. Not only a catalogue, but a wonderful text-book on radio.

Never in the history of radio has there been such a catalog. The radio data and diagrams embracing upwards of 50 pages give the experimenter more valuable and up-to-date information than will be found in many text-books selling for $2; and $1 could be spent for a dozen different radio catalogs before you could gather together the comprehensive listing of worth-while radio goods found in this great catalog.

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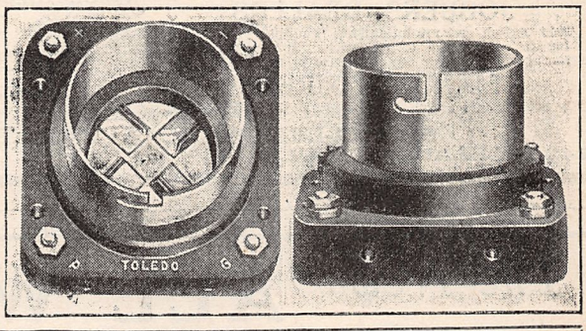
We want live, responsible dealers in every city and town in the United States, both for the sale of our extensive line of radio apparatus and all other worth-while lines of radio goods, on all of which we can quote attractive dealers' discounts. We can offer you facilities and advantages that no other radio house can offer.

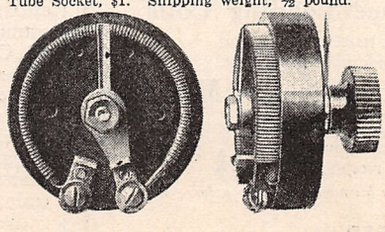
No. A666 Duck's Positive Contact Bakelite Tube Socket is beyond doubt the most advanced tube socket on the market today. To our knowledge there is no other type of tube socket that cannot be forcibly criticized from some angle. Either the receptacle does not easily accommodate the varying diameter of the bases of bulbs, or the notch on receptacle is not just right, or the receptacle is easily subjected to breakage, or connections are in an inconvenient place, or, and most important of all, the type and style of the contacts do not insure positive, certain contact without considerable manipulation.
In our new socket all these defects in other bulbs are overcome. The contact springs are so constructed that contact is made, not only on the bottom of the tube terminal, but also on the side of the terminals. When the tube is put into the socket and turned in the notch, the terminal pins on the tube immediately exert a pressure on the side of the phosphor bronze contacts, making a contact that is firm and sure. The receptacle of our socket is of brass, beautifully nickel plated, and moulded into a bakelite base, with all connections on top. No. A666 Duck's Bakelite Tube Socket, $1. Shipping weight, ½ pound.



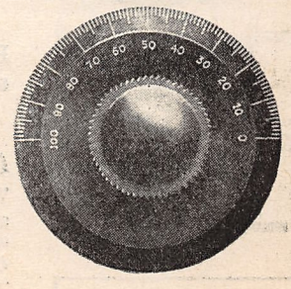
Duck Products have stood the test of time. The largest line in America—58 complete instruments—62 parts.

There are many Duck products that completely dominate all competitive types.

Our new No. A650 Duck Rheostat (at right) has just the necessary amount of resistance to take care of the drop in voltage from the battery when fully charged to the battery at its minimum working voltage. The base is of moulded composition. The resistance element is wound on a black fibre strip, the element being securely fastened in a slot in the base. Contact arm is of phosphor bronze of the proper tension to insure perfect contact and smooth operation. Adjustable to any thickness panel up to ⅜ inch, 2¼ inches in diameter. An exceptional Rheostat at a most popular price. No. A650 Duck Rheostat, $1. Shipping weight 8 oz.



Our Nos. 700 and 701 dials and knobs (right) are of genuine black bakelite. Because of the ribbed construction of the dial it will not warp and being of bakelite it will not discolor. The threaded bushing in the dial which holds the knob is perfectly centered, as is the bushing in the knob itself which takes the shaft. This insures a perfect running dial. The bakelite knob is fastened to the dial by means of a threaded bushing. The set screw which secures the knob and dial passes through the composition and also the brass bushing, thus preventing loosening. Either 3/16" or ¼" knob and dial, $1. Shipping weight, 4 ounces.

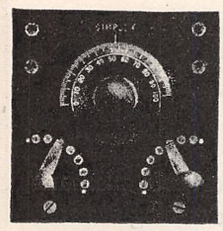


The WILLIAM B. DUCK CO., 231-233 Superior St., Toledo, Ohio

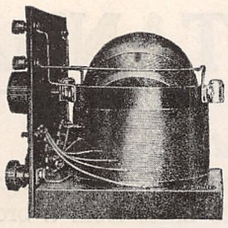
Keystone Radio Lightning Arresters

Keystone Arresters are approved by the Board of Underwriters for the protection of radio receiving sets. They provide permanent protection, have no vacuum to lose nor fuses to blow. They can be installed outdoors and take the place of a lightning switch. For sale by Dealers everywhere or sent post paid on receipt of $2.00. Circular and instructions free on request.

Type B Keystone Arrester, Prize $2.00



Front View of Panel



Simplex Vario-Coupler Panel

SIMPLEX
PANEL UNITS

Simplex Panel Units make it possible to try out the many different hook-ups without disassembling panels. The beginner can first buy one vario-coupler panel and detector panel and get good results. Then he can add other units for greater sensitiveness and selectivity. Simplex instruments are always good and efficient. Circular on request.

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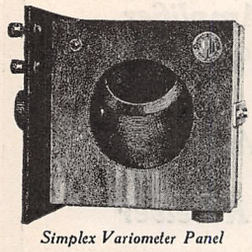
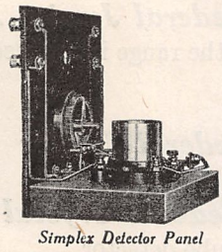
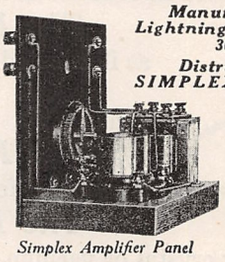


Simplex Variometer Panel

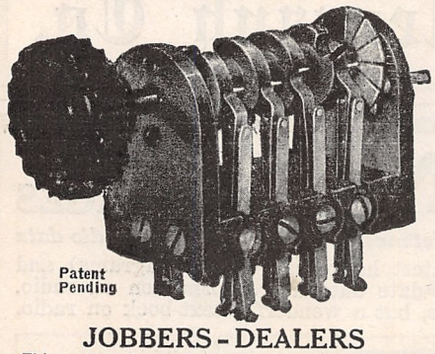


Simplex Detector Panel



Simplex Amplifier Panel

THE STORM-LEE MULTIPLEX ROTARY SWITCH



Patent Pending

The Perfect Amplifier Switch, Gives Complete Control of Detector and 1, 2 or 3 Stage Amplifier, Including Automatic filament control.

The **MULTIPLEX ROTARY SWITCH** takes the place of filament control jacks in the vacuum tube control panel, giving much greater convenience at lower cost. With this switch you may change from detector to any desired stage of amplification by merely turning one knob. Filaments of unused stages being automatically extinguished.

UNIVERSAL IN USE

This switch is adjustable, by loosening one nut the cams may be adjusted to meet practically any switching requirements.

SPECIFICATIONS

INSULATION—BAKELITE
SPRINGS —NICKEL SILVER
CONTACTS —STERLING SILVER

JOBBERS - DEALERS

This switch is revolutionizing amplifier construction, owing to convenience of operation. It will be to your advantage to write for our attractive proposition.

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Why not use this switch in your sets? Write for details.

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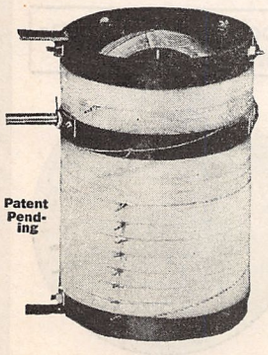
The New "ALL WAVE"

COMBINATION FLAT AND BANK WOUND

Coupler



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With this system it depends upon the normal potential of the grid with respect to the filament as to whether or not a rectified current will flow through the telephones in the plate circuit.

The alterations of the potential of the grid are repeated by increased or decreased flow of current in the plate circuit, as the case may be. To obtain rectification of the alternations produced by A, the circuit must be so arranged that only one-half of the alternation produces a large variation of current in the plate circuit. This is accomplished by adjusting the fixed potential of the grid with respect to the filament.

Presume the grid is held at a certain negative potential by the potentiometer and battery B2. The flow of electrons from the filament to the plate is partially obstructed, but a certain amount of current flows in the plate circuit. When the alternations of A charge the grid negatively, the flow of electrons is still further obstructed and the current in the plate circuit is reduced. When the alternations of A charge the grid positively, the flow of elctrons from the filament to the plate is permited to pass more freely and the current in the plate circuit is increased.

To obtain rectification, however, the potential of the grid may be so adjusted that the increase and decrease of plate current produced by the alternations of A are not in proportion. The grid may be held at such a potential that the negative alternations of A may almost completely obstruct the flow of electrons and the positive alternations greatly increase the flow of electrons from filament to plate. Consequently each positive alternation of A will greatly increase the current flowing in the plate circuit, whereas the negative alternation will only slightly decrease it and tend to completely stop the flow of current.

The alternating current of A is therefore repeated in the plate circuit in the form of pulsations, and it may therefore be said, in the case just described, that only the positive alternations of A produce pulsations of current through the telephones in the plate circuit. If these pulsations occur at a sufficiently high frequency they practically result in a unidirectional current.

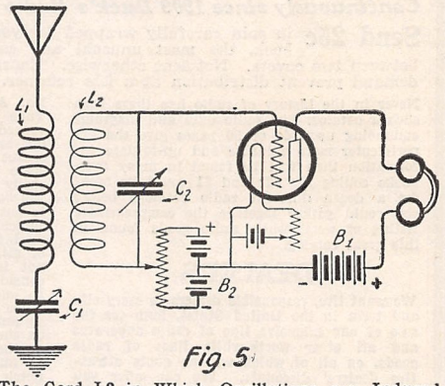

Fig. 5

The Cord L2 in Which Oscillations are Induced Takes the Place of A in Fig. 4. By Maintaining the Grid at a Certain Potential What Amounts to a Rectified Current Flows in the Plate Circuit.

The source of alternating current A may be substituted by the coil L2 in Fig. 5, in which are induced alternations of current at radio frequency. The action of the circuit remains precisely the same. In Fig. 5 the antenna is tuned to the frequency of the incoming signal and the secondary circuit, of L2, C2, is tuned to resonance. An oscillating current produced by the incoming signal is induced in L2 in its inductive relation to L1. This oscillating current is rectified in the plate circuit of the system in the same manner as the alternations of A in Fig. 4 were rectified. Therefore, throughout the duration of a wave train, the telephones in the plate circuit are traversed by pulsations of greatly increased current. At the termination of a wave train, the plate current returns to normal and pulsations are not produced until the next wave train. In the case of spark telegraphy, these wave trains may succeed each other at a fre-

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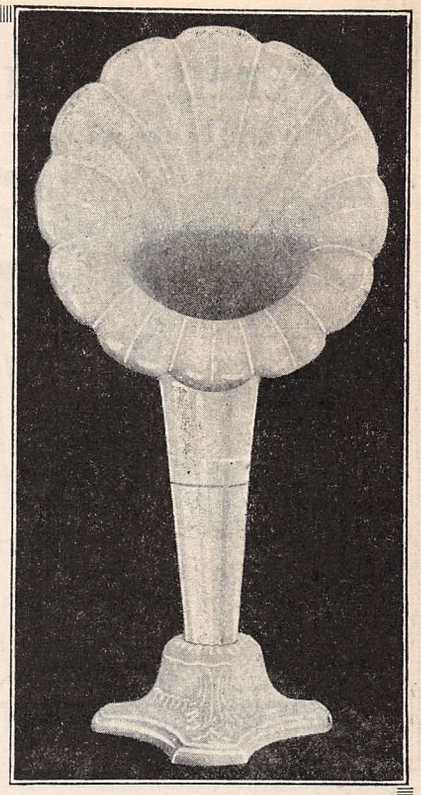

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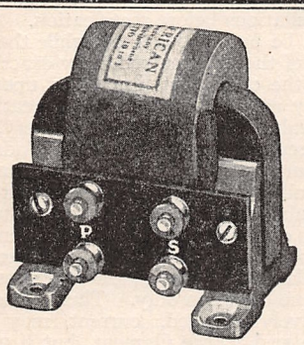

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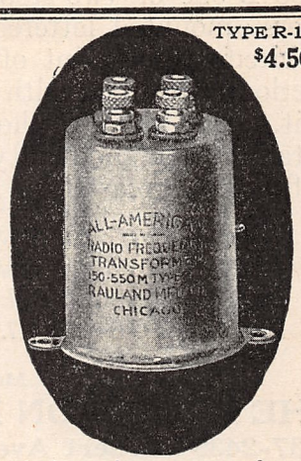

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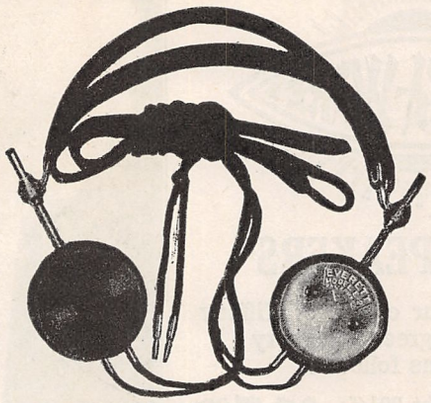

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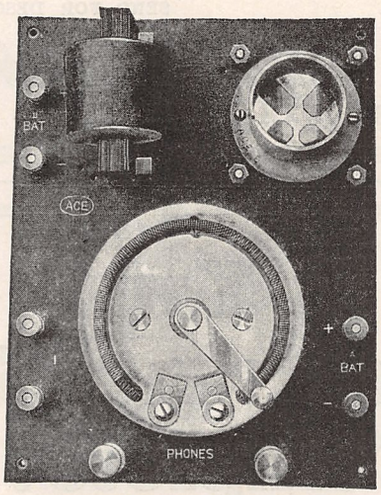

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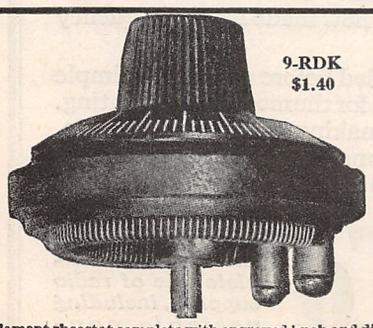

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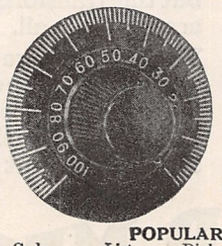

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quency in the neighborhood of 500 times per second. The telephones are therefore impulsed by current 500 times per second and an audible note is produced. So long as the operator of the transmitting station holds down the key of the transmitter, and sends out wave trains at this frequency, an audible note continues in the telephones of the receiving station. By making or breaking the transmitting circuit in accordance with the spacings of the Morse Code, the succession of long and short audible notes in the telephones of the receiving station may be translated by the operator skilled in the code.

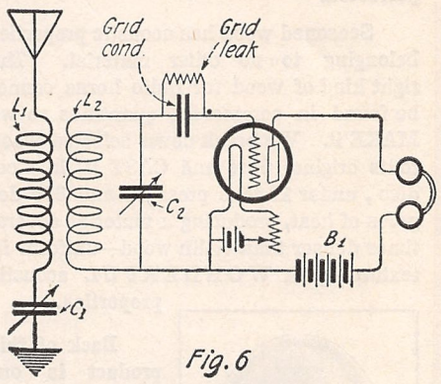


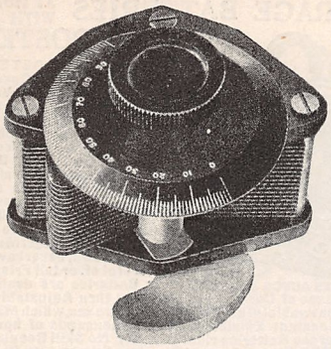
Fig. 6

Another Method of Obtaining Rectification by Means of a Grid Condenser and a Grid Leak

The method of using a potentiometer to control the potential of the grid and obtain rectification in the plate circuit of incoming oscillations is not so much used as the method illustrated in Fig. 6. The system of Fig. 5 is used for the purpose of radio frequency amplification. The potential of the grid is held at such a value that the two halves of the alternating high frequency current produce pulsations in the plate circuit which are in proportion. This is obtained to take advantage of the exact reproduction in the plate circuit of the incoming oscillations to amplify these oscillations before rectification.

It will be understood that, while the fluctuations of the plate current may exactly reproduce the oscillations impressed upon the grid, they are reproduced with a greatly increased value of current by the battery, B1.

The circuit of Fig. 6 is particularly adapted for the purpose of rectification. By connecting a small condenser in the grid circuit, the same results are achieved as by adjusting the potential of the grid with a potentiometer. As previously explained, the space around the heated filament of the audion will pass current in one direction only. Thus if the grid is positively charged, current may pass from the grid to the filament, but if an attempt is made to pass current in the opposite direction, the negative potential of the grid will prevent the flow of current across the space between the filament and grid. When a source of alternating current is connected across the grid and filament, these two elements act in the same manner as two plates of a condenser, which would be alternately charged to a positive and negative potential. However, the rectifying property of the space between the filament and the grid acts as a short circuit of this condenser to one direction of the alternations. Thus in the circuit of Fig. 6, presume that the grid is at a zero potential with respect to the filament. Direct current can pass from the grid to the filament. High frequency alternations are set up in the coil L2 by the incoming signal. Presume that the first impulse is in the direction from the grid to the filament. The grid condenser is charged by the displacement of current, but the space between the grid and filament acts as a conductor and, by reason of this displacement, the grid becomes negative with respect to the filament, and the grid condenser is charged negatively on the grid side. When the direction of current reverses, the grid condenser commences to discharge, but is still negative on the grid side. When the



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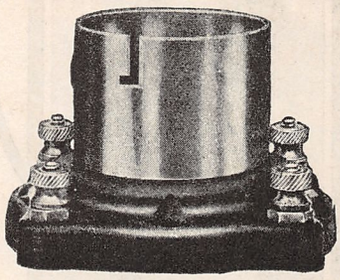

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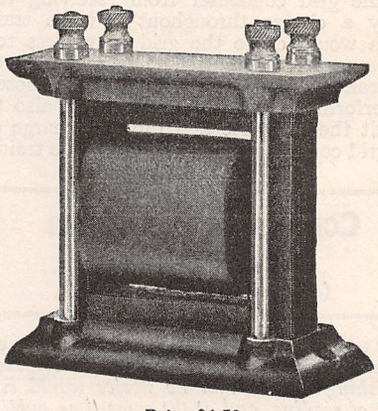

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direction of current is from the filament to the grid, the valve action prevents passage of current and the grid is again charged negatively. Each succeeding cycle causes the grid to become increasingly negative. Consequently throughout a wave train the current in the plate circuit is gradually reduced by the increasing negative potential of the grid.

At the end of a wave train, the source of alternations is removed and the charge on the grid condenser leaks through the high resistance known as a grid leak, which is shunted across the grid condenser. The potential of the grid returns to normal and the plate current also returns to normal. The telephones are thus impulsed by a large variation of current at the end of each wave train. The grid leak also performs the duty of preventing the grid condenser from receiving too heavy a charge throughout a wave train which would cause the grid to possess too high a negative potential. The resistance of the leak must therefore be carefully chosen to perform this latter function and also to permit the complete and rapid discharge of the grid condenser between each wave train.

Correspondence from Readers

(*Continued from page* 453)

made up by the novice, but by those who take an interest in the art as a whole. We will continue publishing articles that no novice would ever think of reading, and at the same time publish those articles that no expert would look at. That is the strength of RADIO NEWS. *It covers the whole field, and it will continue to do so.*

EDITOR)

? BAF BAF-FLES

Editor, RADIO NEWS:

I have been following the articles in the RADIO NEWS, especially the "Correspondence from Readers" section, and I would like to know if I am doing any good work in receiving. So far my work has been confined to radiophone only.

Previous to the time of this letter, I used a regenerative set (variometers), only a detector and a low aerial. I was able to receive all the nearby stations and WJZ, 3ZO, 9ZAF (KLZ) and WOK for the more distant ones. One night I heard someone who gave his call as ?BAF. He repeated "just above Catilina" twice. I would very much appreciate any information as to who it was. Shortly after I had the good fortune to hear a conversation between 2XJ and KDOW. This is my farthest reception unless—but who knows who ?BAF was?

Glad to hear from brother "hams," I remain,

JOHN H. MANLEY,
Harvard, Ill.

A WINDOW SCREEN AERIAL

Editor, RADIO NEWS:

We think that you may be interested to learn that recently we heard radio station WAAW, 186 miles away, using a common window screen in its frame as an aerial. We used a three-stage amplifier and a 14" Magnavox. The very short phonograph record and the market reports could be heard at least 100' away. The screen was connected with the receiver merely by bending a wire and hooking it through the mesh. No solder was used. The screen was located about 20' from the ground on a porch on west side of a three-story, steel reinforced concrete building. At the same height with the screen and not more than 50' away were some trees. One end of the screen rested on the railing of the porch, the other on the floor. The insulated wire connecting the screen with the instrument lay along the floor of the porch and ran in through an open window. Two high tension lines, carrying 2,300 volts,

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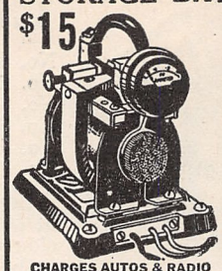

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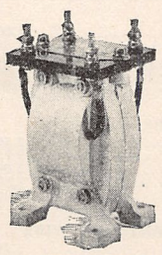

Wonderful Results

are obtained with the new "SECO" Audio-Frequency transformer by real electrical shielding, highest grade core iron and properly proportioned windings. Highest efficiency. Lowest cost, as one B battery is sufficient 2-stage amplification with head phones. Beautifully finished instrument in special aluminum alloy case.

Also "SECO" 2200 ohm standard design Head Sets. A quality product.

SCIENTIFIC EQUIPMENT CO.
RIDGEWOOD, N. J.

Price, $7.50 Postpaid U. S. and Canada

Western and Canadian Representatives wanted.

VOLUTONE

The Newest Thing in Radio. Phonograph Cabinet and Loud Speaker Combined. Assemble present or any standard equipment in this compact cabinet. Proved demand. Deliveries NOW. ***Dealers***—Write quick for prices on this fast seller.

THE VOLUTONE COMPANY
141 West Ohio Street CHICAGO, ILL.

Edelman's "Multitone"

Quality Radio Sets and Parts—Guaranteed Satisfactory—Prompt Deliveries

LOUD SPEAKER DE LUXE

comprising a wood horn, mahogany finish, fitted with Baldwin phone. Can be heard a distance of 200 feet...$27.50

A real loud speaker complete, ready to attach to your amplifier; all-wood tone chamber in base; scientific horn. Only.....$15.00
Complete Two Step Amplifier for above, attachable to any set—only.....$36.00

This Aladdin Multitone Set is not a toy. It comes in a complete package with aerial, phones, lightning arrester, insulators, and all ready for radio music the same night you take it home. Aladdin Multitone Sets (registered U. S. Patent Office) are extra well built.

Buy Your Set Now and Please the Family

Usual range, 30 miles; price, complete with instructions, only $22.00

Extra headset for same, so that four people can hear the radio music at one time.....$8.50

Aladdin Vacuum Tube Set.....$30.00
Comes complete with UV200 Tube, headset, aerial package, no batteries.

FREE WITH EVERY ORDER.—Ask for correct blueprint of Super-Regenerative Set. We sell for $2.00 each, proper size inductance coils: No. 16, for aerial circuit; No. 12, for tickler; No. 33, for .11 henry oscillator inductance; No. 34, for .16 henry inductance. 12,000 ohm resistances for circuit, $1.50 each.

EDELMAN'S MULTITONE GALENA
Every Crystal Guaranteed Sensitive
Super-Tested Price, 35c

SPECIAL EDELMITE Chemical Crystal, "Loud Like Audion," 65c

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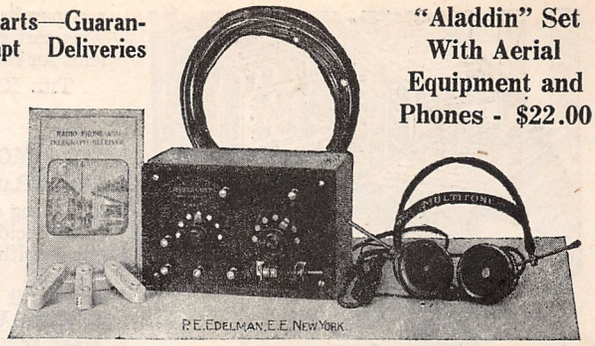
of selected fast selling radio goods, suited for new stores and radio departments. We allow generous discounts. Write fully now and enclose references to save time.



"Aladdin" Set With Aerial Equipment and Phones - $22.00

THROW YOUR AERIAL AWAY—*and* LAUGH AT THE LANDLORD

Attachment for lighting socket, comprising plug, mica condenser, switch, and instructions for use with vacuum tube and crystal sets, price only...$1.95

AMPLIFYING TRANSFORMERS
"Multitone" transformers give enormously greater amplification than most other makes on the market. Each terminal is properly labeled. Exceptional value, only $5.50

MAKE YOUR OWN
Complete parts for constructing two stage amplifier, comprising two transformers, two sockets, rheostats, wire, panel, cabinet, binding posts, with blue print instructions. Price, only $17.90

EDELMAN'S MULTITONE RHEOSTAT
5-ohm 2 amp. capacity, wound on genuine heat resisting lavite base. Price.....$1.50
Same, 4 amp. capacity, two switch arms (patented) so that detector and amplifier tubes can be worked together. Only $2.10
Blueprint showing how to erect the most efficient broadcast aerial for apartment house or residence. Price 25c

EDELMAN'S FAMOUS LOAD COILS
Just attach to your set. Instructions furnished. You can hear government stations which broadcast higher wave-lengths. Sizes, No. 12, No. 14, or No. 16 fit most sets. Only.....$2.00
Special Coil No. 1216 for regenerative outfit, such as Westinghouse R. C. 3.....$3.75

Distributors—Dealers—Agents—WIRE
For Good Proposition

P. E. Edelman, E. E., Mfgr. Est. 1910
9 Church St., New York City

Edelman's Headsets

REAL PHONES. Edelman's Multitone Headsets bring in real music, not merely code buzzes. Genuine Condensite molded shells inclose the latest word in sensitive radiophone receivers. Every headset tested. The new Edelman Headset is a high grade, sensitive tone product. The design is such that you get most efficient sensitivity combined with durability. The name "Edelman Multitone" is cast on every receiver. Accept no substitute. Worth the price.

Double $7.00
Same, single, only..... 3.60

CONDENSERS
Edelman's "Multitone" Condensers are exceptionally high grade. Adopted by leading manufacturers. Complete with beautiful etched dial ready for panel mounting, patent locked plates, machine bushed bearings, vernier adjusting handle, 23 plates, .0005 M.F. Only....$4.50
Same, 43 plates, .001 M.F. (built to last), accurate. Only.....$5.50
Genuine Storage B Battery, 25 volts, made specially by Gould Storage Battery Co. for P. E. Edelman, New York. Price, only.....$8.00
Variometers, large size, each..... 6.00
Variocouplers, large size, each..... 6.00
Edelman's genuine silver contact vacuum tube socket has rubber tires to protect your expensive vacuum tube from damage. Designed for minimum capacity and electrical losses. Use this socket and note the improved results immediately. Price, only $1.00
"Experimental Wireless Stations." Leading instruction book. Postpaid.....$3.00

Ask for Catalogue

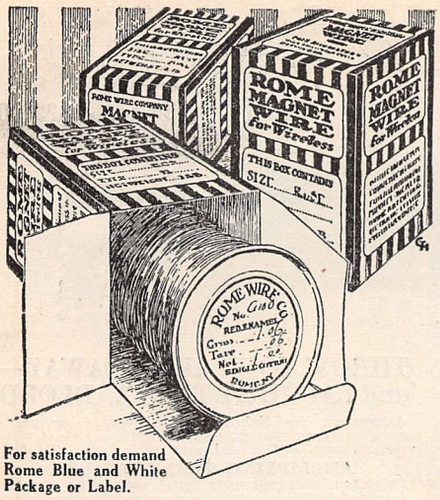
CASTINGS

Brass, Bronze, Aluminum

Our Motto "SERVICE"

The Anchor Brass & Aluminum Co.

Ninth and Freeman Sts. CINCINNATI, OHIO



For satisfaction demand Rome Blue and White Package or Label.

ROME RADIO WIRE

Magnet Wire

Best Quality Plain Enamel Covered; Enamel and Single or Double Cotton Covered; Single or Double Cotton Covered.

All sizes: ¼- lb. to 40-lb. packages.

Antenna Wire

Best Quality Solid or Stranded Copper Antenna Wire, plain or tinned; put up in lengths of 100-ft. and 150 ft., or on 24″ reels of 200 lbs.

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When OPERATORS Are Wanted

Radio Companies are constantly asking us for graduates to fill good positions. They come to us because our long experience in teaching and our fully equipped laboratories have made this school the best in the East.

Enter our class today and, in a few months, you will be prepared to fill an attractive, well-paying job in land or ship stations.

Complete course covers

Arc, Spark and Vacuum Tube Systems

Send for Free Illustrated Booklet

Y. M. C. A. RADIO SCHOOL
158 East 86th St., New York City
"The Best Radio School in the East"

ran parallel to the screen about 100′ away. This sort of an aerial may solve some problems for radio enthusiasts in cities.

THE KEARNEY MILITARY ACADEMY,
Kearney, Neb.

MORE CRYSTAL RECORDS

Editor, RADIO NEWS:

Having read some of the galena records, I have decided to tell you of my own experiences with iron pyrite and silver sulphide crystals. From the time I put up a set last fall, until the last of April, I have received KDKA, WWS, WFO, WOZ, WMH and WGY practically every night. WGY, WWS and KDKA came in the best. WGY was often heard three or four feet from the phones. WOH was copied once; this was, however, in daylight. WFO and WOZ could be heard during their daylight broadcasting.

I now have a regenerative and one-step, but there were five or six boys in town who did the same thing and some who now receive most of these stations daily. As for tuning, we could tune in any of them, although we generally listened to the loudest; but if they persisted in funeral music we tuned for a jazz band from some of the others. For tuning most of us used a vario-coupler with a .001 condenser across the secondary, but a loose coupler worked just as good.

Is galena the best crystal these boys can find? It seems to me that almost any crystal is better than galena. Their reception, no doubt, would be better if they would use "ferron" or "silver sulphide." This should encourage the fellows who are using crystals for regular reception.

J. N. MINER,
Lynn, Ind.

HONEYCOMBS PROVE BEST

Editor, RADIO NEWS:

I am a faithful reader of all your magazines, and I saw that you invited people who thought that they had something to give the public, to please send it to you to be looked over.

I am a licensed radio operator, holding a first-grade amateur license, and I have had quite a lot of experience in that line. You asked for some "Do-funny." Well, here it is.

Most of the radio fans of the present day go to a store for a radio outfit and the salesman says: "Yes, ma'am, we have some very nice ones to-day for twenty-five (25) dollars," just as if he was selling eggs or beans. In all probability he knows as much about wireless as his customer. If they would watch the different magazines for ideas, they would get much farther.

Some radio operators, and nearly all of them will warn all beginners against the honeycomb regenerative inductance for short-wave reception. Well, I have tried every sort of radio outfit that is known to science, and have spent hundreds of dollars for different type sets and arrangements, and I find honeycombs the best so far.

The one of two secrets of the honeycomb coil is a short lead from the secondary coil to the grid condenser and grid leak. This is that thing that so many amateurs don't do, and then wonder why they don't get the results.

Another thing is, DON'T BE AFRAID TO TRY DIFFERENT HOOK-UPS. It was just through my having tried some crazy hook-up one day that did the trick.

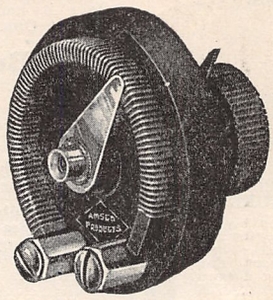
If you have a very large aerial, say about four strands 200′ long, you will use a .001 variable condenser across the primary, and a .0005 across the secondary.

If you have an aerial about two strands 200′ long, you will use a .0005 on the primary with a one-plate vernier attached, and use a .001 condenser on the secondary.

If your aerial is about 200′ long and one strand, use a .001 condenser on the primary and a .001 on the secondary with a 13-plate vernier.

If your aerial is about 50′ to 70′ long, use a

AMSCO Improved RHEOSTAT



Made of the best material obtainable. Tested in our laboratory for the maximum degree of efficiency necessary in RADIO reception.

Resistance 6 Ohms, carries 1½ Amperes current.

Designed for use as either a table or panel instrument.

Indestructible Condensite base, all metal parts, phosphor bronze, polished nickel.

Price $1.10—Shipping weight, 1 lb.

DEALERS—Attention—Do business direct with the manufacturer.

ADVANCE METAL STAMPING CO.
17 Thompson St., Dept. WA-101, New York, N. Y.

AMSCO PRODUCTS REG.

We also manufacture Variable Condensers, Detectors, etc.

UNCONDITIONALLY Guaranteed for 3 Years
(A Written Guarantee)

U.S. Storage Batteries

Supreme for Radio Telephone

6 Volts	20 amp.	$7.50
6 Volts	40 amp.	10.00
6 Volts	60 amp.	13.75
6 Volts	80 amp.	17.50
6 Volts	100 amp.	22.50
8 Volts	60 amp.	17.50

9 Cell B Storage Batteries	22½ V.	$7.50
20 Cell B Storage Batteries	50 V.	13.75
40 Cell B Storage Batteries	100 V.	26.00

If your dealer hasn't it, send money order or check direct

Mail Orders Filled Upon Receipt of Price
PRICE LIST MAILED FREE

Dealers Write for Discounts

U. S. STORAGE BATTERY CO.
FAR ROCKAWAY, N. Y.

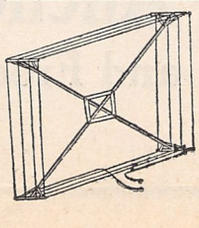
NENCO "B" BATTERIES

LAST LONGER
SERVE BETTER
COST LESS

For amplifying tubes, detector and plate circuit. Nenco "B" Batteries give more hours of service, are moisture proof, silent and free from leaks.

DEALERS
Write for Special offer and discount

National Electric Novelty Co.
53 Walker Street **NEW YORK**



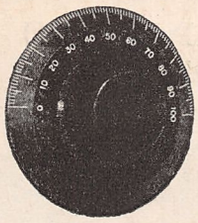
It's easy, make your own
INDOOR COIL AERIAL

Drawing, R. F. amplifier circuit, chart and tables giving proper number of turns to put on coil for any wave length. Complete data covering 0 to 24,000 meters on three large sheets, $1.00. Stamps not accepted.

C. A. DAVIS & CO.
2371 Champlain St., Wash., D. C.

SUNRAID PRODUCTS

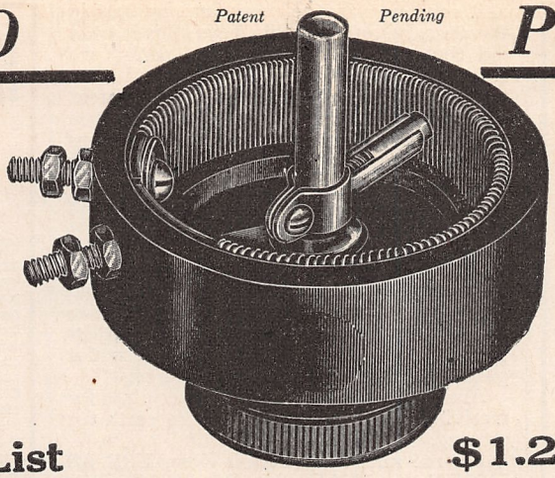
Patent Pending



List Price 3 in. $1.00 4 in. $1.50

Dials

The new improved SUNRAID DIALS are of one solid piece of moulded condensite. The Dials are so constructed that when mounted on a panel they set off $\frac{1}{32}$ of an inch from the surface of the panel, which gives a maximum of efficiency in smooth operation — no gripping.

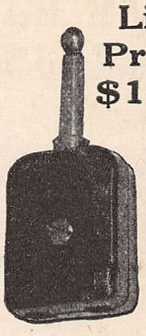


List $1.25

Rheostats

Radio men who want a Rheostat of high class workmanship that gives a maximum amount of service will find it worth their while to buy the SUNRAID RHEOSTAT. It gives perfect contact against winding at all times. (See spring attachment in above photograph.)

Windings guaranteed not to jump out.



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Plugs

SUNRAID PLUGS are made of the best of material—casement of pure bakelite with a high polish. These plugs will take cords with spade or wire tips.

SUNRAID PRODUCTS are always guaranteed. Distributors wanted for all parts of the world. Write for proposition. *Amateurs*—If dealer cannot supply you, write direct and send dealer's name and address.

DISTRIBUTORS—Samples will be sent to you C. O. D. upon request.

SUNRAID RADIO CO.,
534 EIGHTH AVENUE NEW YORK CITY, U.S.A.

Trade Mark

SUNRAID PRODUCTS

Edelman's "Raytainor"

SPECIFICATIONS—Standard model Raytainor, mahogany finish like top illustration, three vacuum tube type, automatic adjustments; only..... **$185.00**

Solid Mahogany, four vacuum tube type, for use with famous Edelman Radio Concentrator requiring no outside wires; only..... **$225.00**

Genuine mahogany, four vacuum tubes, console model; only..... **$375.00**

Special machines up to eight vacuum tubes in cabinets to match your furniture, any range desired—price on application.

"Entertain with the *Raytainor*"

and enjoy the music without any bother

Complete Loud Speaking Receiving Set—1923 Models Now Ready. The Raytainor comes to you ready for use. The experience is in the apparatus.

Order your machine now

Neatly assembled in phonograph type cabinet, this efficient receiving set comes with only two adjustments. No outside aerial necessary.

Harmonizing with home surroundings, the Edelman Raytainor comes complete with all wood tone chamber, free from bother. There is no delicate regeneration. No skill required. The outfit you hoped to get! Here it is, and at a reasonable price.

No permission of landlord required. Full instructions accompany every instrument. Safe from lightning danger. Any bright child can install and operate the Edelman Raytainor. The Raytainor gives you full, loud volume with faithful reproduction of the original radio program.

Sizes and styles to fit all purses. Immediate deliveries from reliable dealers in your locality, or they will order a machine for prompt delivery. Mail orders accepted if your dealer refuses to order genuine Edelman apparatus for you. Send his name.

RAYTAINOR OUTFITS for restaurants, etc. We now supply the RAYTAINOR equipped with Western Electric Power Speaker for loud results in large assembly rooms. No expensive musicians to pay—Radio programs bring trade. Price, complete, including battery, vacuum tubes and everything necessary $475.00

Special Loud Speaker Set in Small Cabinet.... $152.00

Special RAYTAINOR, JR., 3 vacuum tubes, birch cabinet, mahogany finish..... $147.50

All kinds of concerts can be received with the Raytainor.

YOUR OWN RADIO BUSINESS, started now, should bring unusual profits. We supply everything promptly. Others coining sales. We have experience and can assist you. If you own $500 to $5,000 and are ambitious, we can help you succeed. Complete radio sets and parts, we manufacture, sell fast in good locations near Broadcasting Stations. PHILIP EDELMAN, MANUFACTURER, 9 Church Street, New York City.

DEALERS
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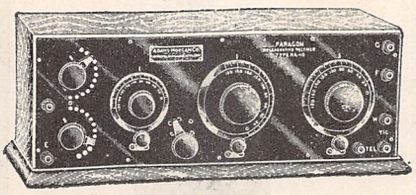
of selected, fast-selling radio goods, suited for new stores and radio departments. We allow generous discounts. Write fully now and enclose references to save time.

Philip E. Edelman, E. E., Mfr., Established 1910
No. 9 Church Street, New York, N. Y. *Phone: Cortlandt 4708*

"2 KL" Broadcasting News of Reduced Prices On Standard Supplies



Sets

Paragon RA-10	$75.00
160-1000 meters	
Paragon RA Special	50.00
160-500 meters	
Paragon DA-2	65.00
Detector and 2 stage	
Grebe CR-5	80.00
Grebe CR-8	80.00
Grebe CR-9	130 00
Grebe CR-10	315.00
Grebe RORK	55.00
2 stage	
Grebe RORD	75.00
Detector and 2 step	

Phones

Western Elec. 2200	13.50
Murdock No. 56 2000	5.00
Murdock No. 56 3000	6.00
Federal No. 53W 2200	8.00
Brandes Supr. 2000	8.00

Tubes

U. V. 200 Radiotron	5.00
U. V. 201 Radiotron	6.50
U. V. 202 Radiotron	8.00
U. V. 203 Radiotron	30.00

Sockets

Paragon No. 25	1.00
General Radio	1.50

"B" Batteries

Eveready 763 22½ v	1.50
Eveready 766 22½ v	3.00

"A" Batteries

Eveready 6 v. 90 amp. hr	18.00
Eveready 6 v. 110 amp. hr	20.00

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Acme A-2	5.00
General Radio	5.00
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Magnavox R-2	85.00
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Rectifiers

G. E. Tungar 2 amp	18.00
G. E. Tungar 5 amp	28.00

"Everything in Radio"
Immediate Delivery
Real Radio Service

Gregory is always glad to give amateurs the benefit of his ten years of practical wireless experience. Just drop him a line; no cost or obligation. Send 25 cents for catalog. This money will be deducted from the first $5.00 order.

A. V. Gregory
42 Broad St., Red Bank, N. J.

Our Radio Department is conducted by electrical engineers, which assure you dependable and highly efficient Radio equipment, either in complete sets or separate units, such as Head Receivers, Variocouplers, Variometers, Cabinets, Detectors, Antennas, Rotary Spark Gaps, Sliders, Panels, Dials, Knobs, Condensers, Grid Leaks, Contacts, Galena Crystals, etc.

R.E.S RADIO ELECTRIC SERVICE PAUL G. NIEHOFF & CO. CHICAGO ILLINOIS MANUFACTURERS

We especially recommend our popular Receiving Set, RESODON, which is one of the most desirable outfits for the home, club, etc. This set comes in a beautiful mahogany finished cabinet. Write for literature.

PAUL G. NIEHOFF & CO., Inc.
Electrical Laboratories and Manufacturers
238 E. Ohio Street, Chicago, Illinois

.001 condenser in the secondary, an .001 in the primary, and, get this, boys, this is what did the trick. USE AN .0005 across the tickler coil.

To obtain the best results with the different combination of condensers that I have given you, you ought to use 2 coils with 35 turns each and the other should be either a 75- or 50-turn coil.

So many never think of putting a condenser across the tickler coil, but try it, fellows; you'll be surprised.

To obtain best results the lead-in from your aerial should not be any more than 10', and your ground lead should not be more than 10'. I recommend and use Connecticut variables; they are the best condensers for phone and C. W. work that I know of.

Always ground your set on water pipes for receiving and on or rather in the earth for sending.

Let me reiterate before I close, USE AS SHORT A LEAD AS POSSIBLE BETWEEN THE SECONDARY COIL AND THE GRID CONDENSER. NOT LONGER THAN THREE TO FOUR INCHES AT THE MOST.

NICOLA G. D'ASCENZO,
Germantown, Pa.

A BOOST FOR GALENA

Editor, RADIO NEWS:

In reference to Mr. John M. Shanner's article appearing in the July issue of RADIO NEWS, regarding distances worked or received, using only Galena for a detector, wish to submit the following.

The records below were all over water with the exception of one from NAA which was partly over land and partly over water.

These distances were covered while I was Radio operator on the *S.S. Standard Arrow* (KSV).

On the night of September 19, 1916, on the Pacific Ocean off the Central American Coast and approximately 3,300 miles from NAA, received time signals.

On the night of October 7, 1916, at sea, worked direct with (KPH) San Francisco, Calif., distance approximately 2,670 miles. Messages were sent to him without repeats.

On the night of February 23, 1917, received signals from (KPH) QSA, distance 3,397 miles. Fading very bad.

These were taken from a private log, which I kept, of such records.

The above were not freaks, as there are many other entries in my log between those shown above and I must say that Galena is SOME detector mineral.

Let's hear some more on this subject.

W. C. THOMPSON,
Los Angeles, Calif.

CANADA AWAKE

Editor, RADIO NEWS:

On page 66 of the July issue of RADIO NEWS, W. E. Weaver, of Hespeler, Ontario, states in an article that there are no broadcasting stations in Canada giving nightly concerts.

Mr. Weaver is behind the times, as we have two in this city giving as good nightly concerts as one would wish to hear, and I am sure that from here to, and including Vancouver, there are a few more.

Rig up a two-step, Mr. Weaver, and get in on some good Winnipeg music any night in the week given by the *Free Press* or *Tribune* and "see Canada first."

E. DORAN,
283 Toronto Streeet, Winnipeg, Can.

POWERFUL BROADCASTING STATION IN CANADA

Editor, RADIO NEWS:

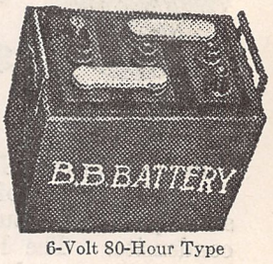
I have read with interest the letter in your July issue on "Canadians becoming Americanized," by W. E. Weaver, of Hespeler, Ont. Mr. Weaver's letter is inclined to give your United States readers the impression that there are no broadcasting stations in Canada, and such is not the case. There are, to my knowledge, the following very powerful broad-

RADIO "A" BATTERY

Regular Price $10.50
Special $7.50

18 MONTHS' UNLIMITED GUARANTEE

This new battery is 6-volt 25 hours, has heavy plates and connections and is built especially for Radio from fresh material in our own factory. Compact, strong, efficient, convenient to handle. Covered by our unlimited 18 months' guarantee.



6-Volt 80-Hour Type

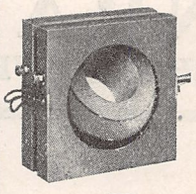
Other Sizes at Special Discount

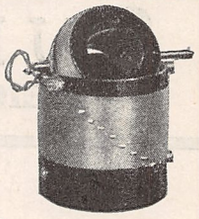
All fresh, new, specially built, with heavy plates and connections and covered by our "Unlimited 18 Months' Guarantee." Ready for use when unpacked.

6-volt 25-hour—Regular, $10.50—**Special, $7.50**
6-volt 60-hour—Regular, 20.00—**Special, 15.00**
6-volt 80-hour—Regular, 22.50—**Special, 17.50**
6-volt 100-hour—Regular, 25.00—**Special, 20.00**

Prompt Shipment; Prices F. O. B. Toledo, Ohio

THE B-B BATTERY CO.
89 B-B Bldg., Toledo, Ohio





Ra-Fone

Variometer $3.80

Stators 4½ inches square, rotors 3½ inches. Double cotton covered windings, No. 22 wire set in insulating varnish. Flexible leads to 3½-inch secondary. Clear insulating varnish finish. Mounts flat to panel with 2 countersunk screws.

Both guaranteed to be of very best material and workmanship and to receive perfectly up to 500 meters when properly installed. Immediate shipment by parcel post on receipt of price. Satisfaction guaranteed or money back.

Vario-Coupler $3.80

Primary wound on 4-inch black dielectric tube with 9 single taps and 8 nine-turn taps. Taps are soldered on brass strips and turned to allow easy soldering connection for user. Rotor 3 11/16 inches in diameter, making very close coupling with primary. Rotor finished with flexible leads through hollow rotor shaft. Primary and secondary both wound with No. 22 green silk covered copper wire — 44 turns on rotor, 80 turns on primary. Finished with clear insulating varnish.

Ra-Tone Electric Co. 916 Park Place West DETROIT, MICHIGAN.

Complete Receiving Set for $20.00

Material mounted on panel but unwired. Hook up yourself. Book of wiring diagrams furnished with each set.

Set consists of
1 Hard Rubber Panel 7 x 21"
3 " " Dials 3"
2 Variometers
1 Variocoupler
2 Inductance Switches
1 Socket
1 Rheostat
1 Comb. Grid Leak Condenser
1 Phone Jack
Wire, Tubing, Terminals, etc.

The above, combined with two-step amplifier, $35.00, unwired.

Send for price list of our complete line.

C & K RADIO MFG. CO.
299 SEVENTH ST., BROOKLYN, N. Y.

casting stations in Western Canada alone, and possibly more that I do not know of. Manitoba *Free Press*, Winnipeg *Tribune*, Edmonton *Journal*, and Calgary *Daily Herald*. If there are no broadcasting stations (Canadian) within reach of Hespeler, some of the large eastern cities need to take a lesson from the west. I agree with Mr. Weaver that it would be possible to get too much U. S. broadcasting if they were in the nature of patriotic speeches, but most of the programs are musical, something we cannot get too much of. As a reader of the *Free Press* I notice every day letters to the Editor from the states directly to the south of us saying how well they liked our programs. If we broadcasted patriotic speeches from here, the same thing might apply to the United States radio bugs to the south of Winnipeg. As a Canadian, I appreciate Mr. Weaver's patriotic spirit, but I wanted to let your readers know, as a good many of them do, that we have broadcasting stations in Western Canada and some United States readers who have small sets will hear nothing but Winnipeg concerts, as by the broadcasting chart shown in your July issue we are closer to them than the United States stations, of which there are very few in the Northwestern States.

WILLIAM A. H. LORD,
Winnipeg, Can.

We take pleasure in reprinting the following from the Free Press *of Manitoba, Canada:*

(*The reason why Canadian broadcasting stations were not mentioned in our columns is that none of them ever send any information about their schedule and range so that we could publish them for the benefit of everybody. Regarding the statements made by Mr. W. E. Weaver, it is the policy of the magazine to let the writers of articles assume full responsibility of their statements as in most cases it is impossible for us to verify them.*—EDITORS.)

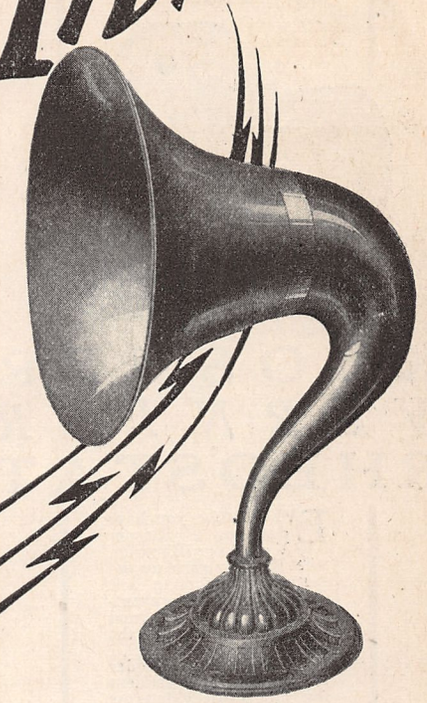
"In a recent issue of the RADIO NEWS, a magazine published in New York and devoted to radio, there appeared, in the correspondence columns, a letter from a self-styled Canadian, who deplored the inevitable Americanization of Canadians as a result of listening-in on radio concerts broadcasted from the other side of the international boundary. This terrifying prospect was ascribed to the fact, according to his own startling statement, that there are no 'regularly nightly' radiophone concerts given in Canada.

"This is particularly amusing, in view of the fact that the *Free Press* has, for months, been broadcasting special concerts almost every night and that radio stations in Minnesota and North Dakota, which come within the supposed fields of at least two large American cities, Minneapolis and St. Paul, have in the past month frequently complimented the *Free Press* on the excellency of the concerts distributed. Letter after letter received by the *Free Press* radio department states emphatically that CJCG (*Free Press*) can be heard more distinctly than any other broadcasting station.

"Speaking from the depths of an arrogant ignorance, the writer, W. E. Weaver, Hespeler, Ontario, made the unqualified statements that the boys of Canada, the coming generation of the country, are being exposed to an unavoidable American influence which may result in a loss of their own pride of nationality; that American pronunciations threaten to creep into Canadian ways of speaking, that American geography may become more familiar than that of their own country, and that American ways of thinking threaten to stifle Canadian individuality. All these dangers he ascribed 'to the fact that there are in Canada today no broadcasting stations giving regular programmes for Canadian operators.' Only in one way, he said, could these dangers be curbed. Canadians must cease being narrow-minded and tight-fisted, must realize the necessity for broadcasting stations, if their national life is to be saved from extinction.

"These statements regarding radio in Canada are made in the face of the fact that

Tune In—

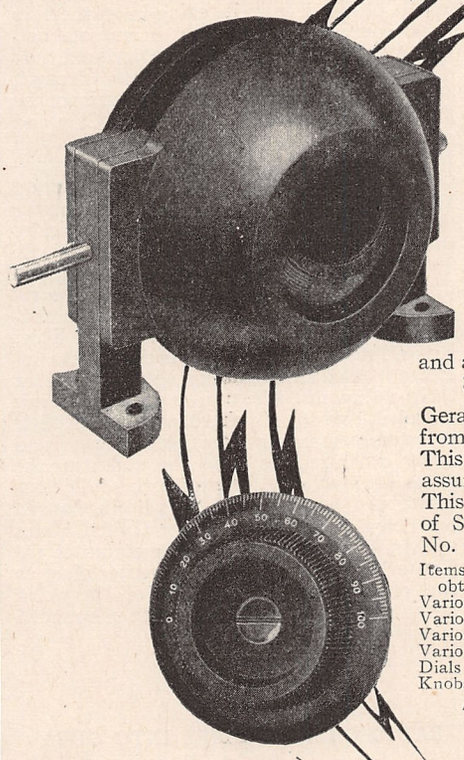


The Music Master Radio Amplifier greatly magnifies sound volume with reproduction free from any harsh metallic screeching. The horn is made from richly grained mahogany and with the nicely finished goose-neck and base provides a handsome yet practical radio necessity.

Made in two sizes:

21 inch for concerts and out of doors.....$45.00

14 inch for general use in home.....$35.00



Geraco Variometer and Variocoupler assemblies are a long step ahead in the development of accurate tuning instruments, being the perfected result of exhaustive tests by competent experts. Note the detail of design (see variometer illustrated to left), the composition posts and absence of unnecessary metal parts.

Price each.....$6.00

Geraco moulded dials will improve the appearance of any set. A smooth black surface that will not discolor or chip. Neatly finished and accurately calibrated.

3¼-inch size.....75c

Geraco moulded parts are carefully manufactured from a durable and tested industrial compound. This dielectric substance has proved qualities which assure our guarantee of minimum power loss. This fact is borne out by the opinion of the Bureau of Standards of the United States. See circular No. 74 Radio Instruments and Measurements.

Items in the Geraco line now obtainable:
Variometers, complete
Variometer rotors
Variometer Post Assemblies
Variometer Stators
Dials
Knobs
Variocoupler, complete
Variocoupler Tubes
Variocoupler Balls
Vacuum Tube Sockets
Crystal Detector Bases
Aerial Insulators
Music Master Radio Amplifiers

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Manufacturers and Distributors of
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made into LOUD speakers. I will supply Horn and Box, price reasonable. BALDWIN PHONES repaired, adjusted, tuned and new diaphragms put on. Wireless receiving sets built to order, repaired, etc.

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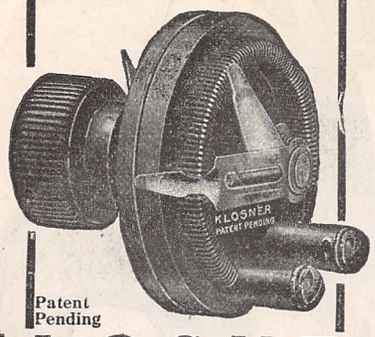

Patent Pending

KLOSNER VERNIER RHEOSTAT

EVERY tube you have deserves a Klosner Vernier Rheostat. The Klosner *wire wound* feature produces a low starting current preventing sudden strain and thereby prolonging the life of the tube.

The Klosner provides micrometer adjustment for your critical detector tubes. One single knob controls both the rough and vernier adjustments. It is unsurpassed for loudest reception of telephone and CW, and is essential for detector tubes of radio frequency amplification. Awarded the New York Evening Mail's Certificate of Excellence. Insist on the genuine—made only by the originators. Look for the name "Klosner" moulded on the base. The cost is no more than for other Rheostats without these exclusive features. At your dealer or send for interesting literature. Klosner Improved Apparatus Co., Dept. N, 2024 Boston Road, New York City.

Dealers: This is the fastest moving rheostat on the market. It is stocked by all leading jobbers. Get your supply from them.

One Single Knob No Sudden Strain

$1.50

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Write us for full information concerning **RADIOBAT B**

the revolutionary battery for wireless telephony

MULTIPLE STORAGE BATTERY CORP.
350 MADISON AVE., NEW YORK

there are today in this country 27 commercial broadcasting stations scattered over thousands of miles of country from the Atlantic to the Pacific, and supplying to practically every populated district of the country radio concerts seven nights in the week. Of these stations three-quarters are conducted by newspapers, every one of which is endeavoring to give to the thousands of amateur operators of the nation the very best entertainment available. The Canadian atmosphere is filled every night with programmes of musical, educational and instructive interest.

"Abysmal ignorance of his own country, as it is today, is to be regretted in the writer to the RADIO NEWS as characteristic of the poorest of citizenship. But when his ignorance is passed on to the readers of a magazine having a circulation of nearly 250,000, to be accepted by them as the truth, it becomes a matter for active correction. It is also surprising and regrettable that a publication supposedly directly in touch with the latest developments of the scientific marvel of the age should permit such statements to appear in its columns when they are directly untrue.

"From three states of the country which, in the words of the correspondent of the RADIO NEWS, supplies Canada with all her radio entertainments, reports of excellent reception of broadcasts from the *Free Press* station, CJCG, have long been pouring for months past. Enthusiastic over the excellent results obtained from listening-in on the *Free Press* concerts, operators in Minnesota and North and South Dakota have declared they obtain better results, in clearness, strength of signals, and quality of modulation from the *Free Press* station than from Twin City and other stations to the south. From the North Dakota Agricultural College, a state institution, comes a report, forwarded by Sigmund W. Leifson, instructor of radio communication, that the *Free Press* station is practically the only one heard regularly in Fargo, N. D. The Dakota Engineering and Construction Company, of Valley City, N. D., reports greater satisfaction from *Free Press* broadcasts than from any others heard. The Thief River Falls, Minn., Elk's club reports increased attendance during the evenings at their clubrooms, where a receiving set was installed, and for which 90 per cent. of their entertainment comes from CJCG. These, and many other reports from the states to the south of Manitoba, illustrate the ridiculous falsity of the conception of radio in Canada broadcast to radio fans of the United States by Mr. Weaver, through the medium of the RADIO NEWS. Canada is taking her place as one of the leading countries of the world in the use and development of the unbounded possibilities of radio telephony."

RADIO CRAZE CREEPS INTO CUBA

According to Consul Harold D. Clum, of Santiago, Cuba, there is an increasing interest in that city in radio telegraphy and telephony, and it is intended to install a broadcasting station powerful enough to be heard in every town in Oriente Province.

The majority of receiving stations now in use have been constructed by amateurs or assembled from parts obtained from the United States, but as American firms are oversold, much difficulty has been experienced in getting deliveries on orders placed in this country.

The proximity of Cuba to the broadcasting facilities of the United States adds to the possibilities for developing a market there for radio sets.

WHAT'S AN ANNOUNCER?

He's the guy who must be careful what he says when he stumbles over a rug or something.

By A. J. De Long.

Belden Radio Cords

Years of association with the Radio Industry are a guarantee of satisfaction. Ample facilities are an assurance of prompt service. Let us quote on your requirements.

Belden Manufacturing Company

Electrical Wires, Cables and Cordage

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Guaranteed Radio Apparatus Plus Real Personal Service

Our service to a customer does not stop with the sale and while we confine our sets and appliances to the products of the most reputable manufacturers, bearing their full and unconditional guarantee, we gladly offer suggestions and make tests in order to give the utmost satisfaction.

Our Laboratory Service

is at the constant disposal of every customer—every piece of apparatus is fully tested as to its properties.

A complete line of receiving sets and appliances constantly on hand, including Choke Coils and Resistances for Armstrong Circuits.

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MAGNET ½ LB. SPOOLS WIRE

No.	Enaml.	S.C.C.	D.C.C.	S.S.C.	D.S.C.
18	.32	.40	.45	.70	.80
20	.35	.45	.48	.72	.84
22	.40	.52	.56	.74	.90
24	.44	.56	.60	.78	1.05
26	.48	.60	.66	.90	1.15
28	.53	.66	.78	1.00	1.20
30	.56	.88	.96	1.14	1.50

½ lb spools 46% less. Other sizes at proportionate prices.

1 lb. spool add 90%

No C. O. D.

Immediate delivery P.P. Free in U.S.A.
Stamps not accepted in payment of orders
Circular for stamps.

AMERICAN RADIO COMPANY BOX 133 BALTIMORE, MD.

Vesta "A" and "B" batteries for radio sets are noted for their long life.

VESTA

COSTS LESS PER MONTH OF SERVICE

C-B RECEIVING SETS
1-2-3 Steps
RADIO FREQUENCY
Loud Speaker on 6 in. Loop Fits Phonograph Cabinet
Cooper-Byron Radio Electric Corp.
507 Summit Ave., Jersey City, N. J.

In the New Era of Radio

(*Continued from page 431*)

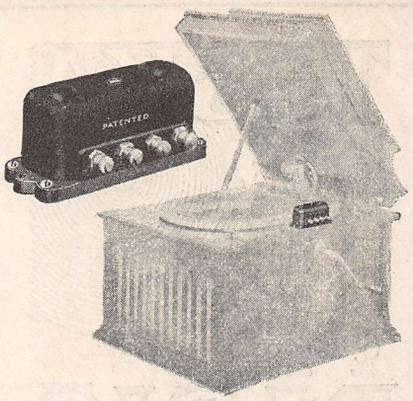
York City Tower, finally decided that the proposition was not sufficiently feasible! But this New York City paper was not alone in failing to realize the immediate future of radio. Countless other newspapers who were approached and besought to take up this new method of reaching their readers and countless new readers, at least for ball scores, racing returns, and the like, refused one after another to be interested.

CAMPAIGN SPEECHES INTO EVERY HOME

Already the political possibilities of radio broadcasting appeal quite logically to the editorial commentators on the future use of this medium. That the President of the United States, or a candidate for election to that office, can send his voice directly into every home in the nation, reach vocally the ear of every voter—is indeed a startling thought. It grips the imagination as nothing else in all the history of politics has gripped it.

Certainly to hear in your own ears the actual intonation of the President or candidate, to feel the personality of his voice, speaking intimately as in the same room (not as on the rostrum of a great auditorium), will give one a sense of personal content, of actual acquaintance with the man, his real self, which only his associates have hitherto been privileged to experience. The change which broadcasting will thus effect in the hearts and minds of American voters, in their heretofore methods of sizing up, of diagnosing a candidate and the policies he advocates, is certain to be profound. It may be somewhat unfair. The candidate with the best speaking voice may make a far more persuasive appeal than the cause he espouses merits—an appeal which the printed reports of his speech could never carry. The results time alone can declare.

Radio Music Perfectly Reproduced Through Your Phonograph



The Dulce-Tone Junior converts your phonograph into the finest of loud talkers without detracting in the least from its power to play phonograph records.

The radio music comes to you with cello-like sweetness, even more clearly than that reproduced from your records.

The Dulce-Tone Junior is adaptable to any phonographic instrument. When you consider that you are using the wonderful sound-box, tone-arm and even the needle which has been perfected only after years of experimenting, you can realize the QUALITY and SWEETNESS of the tone which is so faithfully reproduced through the Dulce-Tone Junior.

Any one can attach the Dulce-Tone Junior in a few minutes. To operate, simply swing the tone-arm, allowing the needle to rest on the small center element of the Dulce-Tone Junior. This ingenious instrument eliminates the necessity of numerous expensive head-phones when entertaining a roomful of people—is a true economy.

The Dulce-Tone Junior is the instrument of the century—an instrument that will improve any radio set. Put one on your phonograph today and realize the possibilities of radio music for quality of tone.

RETAIL PRICE ONLY.....$15.00 ($17.50 West of the Rockies)

If your dealer does not handle the Dulce-Tone Junior, fill out the coupon below, mail it with one dollar, and we will forward this wonder instrument to you C. O. D. at $14.00.

COUPON

THE CLEVELAND RADIO MFG. CO.
234 St. Clair Avenue N. E., Cleveland, Ohio

Enclosed find one dollar for which send me a Dulce-Tone Junior ($14.00 balance due C. O. D.)
Send me your folder entitled "Waves to You Through Your Phonograph."

Name.....

Address.....

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The Cleveland Radio Mfg. Co.
234 ST. CLAIR AVENUE, N. E. CLEVELAND, OHIO

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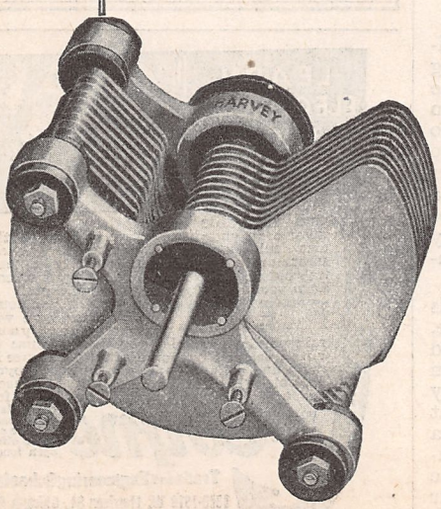
EMPIRE
ELECTRIC APPLIANCES

Radio Apparatus with that "BUILT-IN QUALITY"

"Designed Then Built"

Every part made in our own factory, backed by years of experience in the Radio and Electrical Industry, carefully tested and packed in individual cartons

MACHANICALLY PERFECT
ELECTRICALLY RIGHT
RADIO EFFICIENCY



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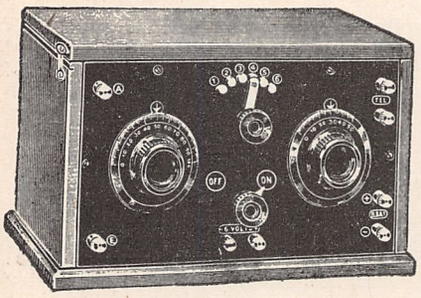
VARIABLE CONDENSERS

TWO-STEP AMPLIFIERS

EMPIRE TRANSFORMER DIVISION
HARVEY ELECTRIC COMPANY
2000 Southport Avenue CHICAGO, ILL.

TUSKA

RADIO



Type 224—Price $35

Tuska Regenerative Tuner (Licensed under Armstrong Patent No. 1,113,-149) Ready for Tube, Phones, and Battery. The ideal outfit for expert or beginner. Two knobs—one for wave length, the other for amplifying. Wave length range 150-650 meters. Type 224 has stood the test of public trial.

Dealers write your nearest jobber.

Send 5c for New Tuska Catalog No. 3

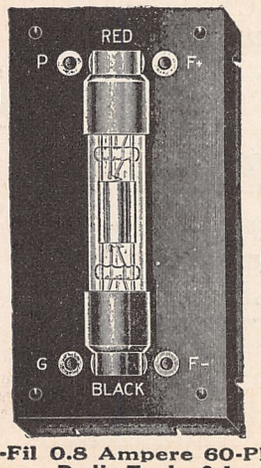
The C. D. Tuska Company

2 Bartholomew Ave., Hartford, Conn.

RAC-AUDION

AUDION $5.00

5 TIMES THE AMPLIFICATION OF THE ORDINARY TUBE



RECEPTACLE $1.00

WRITE FOR INFORMATION AND DIAGRAM USING RAC CHOKE COILS

4 V-Fil 0.8 Ampere 60-Plate

New Jersey Radio Equip. & Install. Co.

120 BIDWELL AVE. JERSEY CITY, N.J.

Next October we shall see the first test of the "Radio Harangue." A truce to jazz and bedtime stories while the candidate for re-election on the anti-Prohibition platform in New Jersey before his invisible audience debates with the Honorable Volstead, who will demonstrate (radially) that bootleggers and home-brewers should be massacred by machine guns. Little doubt the ether enfolding our earth will work overtime next fall.

RADIO SOLVES AN ECONOMIC PROBLEM

But the political and news-spreading applications are by no means the most important of radiophone broadcasting. The capability of putting daily and nightly a well-chosen variety of entertainment and education into every household throughout our land in city and town and hamlet, into every farmhouse, every ranch shack, every mining camp and cross road store—is one whose far-reaching power for genuine, for lasting good, no one can now fully estimate.

For years the tide, in our own and foreign countries, has been setting in from the rural to the city districts, from the sparsely peopled to the already crowded sections. The producer class is steadily diminishing relatively to the ever increasing class of consumers. This of course means constantly increasing costs of living—in the cities, with no such corresponding increase in returns to the producer, the farmer, the stock-raiser. Their lives are hard at best, and for the most part lonely, especially during the winter months.

The problem of obtaining and keeping farm labor becomes each year more difficult, as the call of the city and even of the small town becomes more and more attractive. The desire for shorter hours of labor, the craving for excitement or recreation at night, the gregarious instincts of man—are calling the youth, boys and girls, from the farm to the town, from the town to the city. The evil cuts both ways—depopulating country and congesting cities. Nothing can be of greater service to the entire nation than an agent, a motive which will supply to the dweller in isolation, the labor and the youth on the farm, and in the country villages, a genuine and ever novel means for entertainment, for amusement, and enjoyable education.

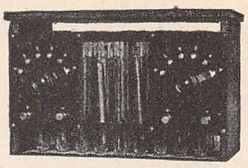
It is the almost complete lack of these elements more than the isolation from the crowd, which has rendered life on the farm and in the smaller towns so dismally monotonous, so hard. There are frequent long intervals where the work on the farm is itself not hard, or would not be could a little hired help be retained; but ah, the loneliness, the deathly monotony! So few of us are self-resourceful, or good companions to ourselves!

To such as these, to all of these, and therefore to almost half of our population, comes the radiophone as a twentieth-century cure for an ailment centuries old and rapidly growing worse.

AMERICA AN ELECTRICAL NATION

Only to-day, after many years of skepticism, the newspaper world is just beginning to realize the ally which the radiophone means to them. Several hundred newspapers in the United States now print the regular radio programs in each issue. Many of these also print a daily column of "radio helps," or radio information; some print each week a special radio supplement, or devote one or two pages exclusively to the subject. Surely this indicates a keen desire for radio information on the part of their readers.

Pause a moment to consider what this widecast diffusion of electrical knowledge, this arousal of universal interest in radio and electrical technics will mean to the American nation if long continued. We shall rapidly become an electrical people—the elements at least of electrics and physics, heretofore a closed book of mysticism to all but a comparatively few, will inevitably become the daily thought and talk and custom of our masses. The man or woman who heretofore



KICO Radio "B" Storage Batteries for EFFICIENT Receiving

THINK over the following FACTS before making your next "B" battery purchase:

1. KICO "B" batteries allow single cell adjustments by means of switches mounted on panels. (The first storage "B" battery on the market with this feature.)
2. Rechargeable from your 110-volt A. C. line in series with the rectifier supplied with each battery.
3. One charge lasts from three to six months in the detector plate circuit.
4. Highly finished, durable and compact.
5. Life unlimited, as overcharging, short-circuiting or standing idle does them no injury.
6. Not an ACID battery.
7. One quart of distilled water puts the battery into service.
8. Your money back if unsatisfied within a 90-day trial.

		(Plain)	(Panels)
16 cell	22 volts	$6.50	.....
24 cell	32 volts	8.00	$12.00
36 cell	48 volts	10.00	14.00
50 cell	68 volts	12.00	17.00
78 cell	100 volts	16.00	21.00

Drop us a line for literature.

KIMLEY ELECTRIC COMPANY

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This Book On Home Beautifying Sent Free

Contains practical suggestions on how to make your home artistic, cheery and inviting—explains how you can easily and economically refinish and keep woodwork, furniture and floors in perfect condition.

--BUILDING??

If so, you will find this book particularly interesting and useful, for it tells how to finish inexpensive soft woods so they are as beautiful and artistic as hard wood. Tells just what materials to use—how to apply them—includes color card—gives covering capacities, etc.

Our Individual Advice Department will give a prompt and expert answer to all questions on interior wood finishing—without cost or obligation.

We will gladly send this book free and postpaid for the name and address of one of the best painters in your locality. And for 10c we will also send you postpaid a 2 oz. bottle of Johnson's Liquid Prepared Wax.

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LEARN ELECTRICITY IN 3 MONTHS

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Make this the most profitable and enjoyable summer of your life. Come to Chicago, the electrical center and the country's greatest summer resort city. Learn Electricity in America's oldest, largest and best equipped school. Earn your way, free employment dept.

FREE R. R. FARE If you come now we will pay your railroad fare and give you *free* a course in auto truck and tractor electricity, a course in radio, and a life sholarship in the great Coyne School. This is the greatest offer ever made by a school. Write at once for particulars as we cannot keep this offer open long.

Write Today **Coyne** Trade and Engineering Schools

1300-1310 W. Harrison St., Chicago, Ill.

Dept. 119

has complacently admitted that "all this wireless is absolutely beyond my grasp or comprehension"—will become a curiosity—as much of an ignoramus or mental mossback as are those who know not what causes the tides, or that the stars are similar to our sun.

A generation of such intimate familiarity with electrical apparatus and knowledge of the fundamental laws governing radio phenomena must inevitably bring about a rapid development in all electrical lines which, lacking new stimulus, would require perhaps a hundred years to equal.

This, I am convinced, is to be one of the lasting, far-reaching, wealth producing results of this new American institution. Those who are listening in nightly to radio entertainment and instruction will surely take kindly and understandingly to brief, well-elucidated lectures on the principles involved in the apparatus they themselves are personally handling—to clear, concise explanation by masters in the art of electrical instruction, of the physical principles which make possible this modern miracle, and as also other and more general scientific information will be assimilated by thousands and millions of Americans who otherwise would never be induced to read or attend a series of lectures on science of any description. And this primary scientific education will be sugared with entertainment, made so easy of acquisition at the home and fireside that its seeds of knowledge cannot fail to fall on a myriad of receptive minds which could in no other way receive it, and where it grows must awake a hunger for new and deeper knowledge.

And America, already the world's leader in this field of invention and application, will thereby in my opinion so far lead and surpass the other nations as to defy comparison. This at least will continue to be the situation until England and France and Germany, following our enlightened example, lift their stupid governmental bans on broadcasting, and exert their power to compete with us in universal electrical education for the home.

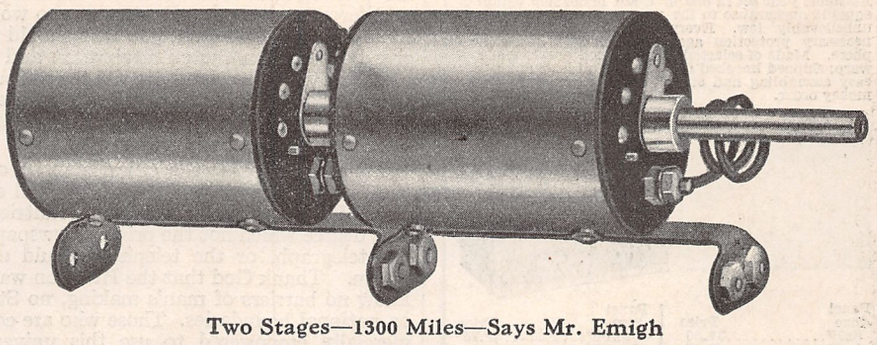
IN THE NEAR FUTURE

And then radio-receiving stations will spring up mushroom-like over the entire civilized world, to be numbered by the hundred million. For the radio, engineers and directors, the newspapers and all governments will, for a variety of reasons, ranging from financial reward to politics, see to it that its necessary broadcasting stations are installed, the necessary programs daily maintained.

But just what this new power of reaching each day the ears and the attentive minds of every dweller in the nation means to our nation none of us can yet clearly foresee. Surely the firm grip with which radio telegraphy still holds the original amateurs after the past ten years is proof sufficient that the hidden voice will always find its hidden listeners. The telegraph meant hard work and concentration. The radio telephone is unalloyed pleasure and interest, not for one member of a family who has possessed the time and energy to master Morse, but for every one and for the neighbors also.

Certain writers deplore the fact that at present radiophone broadcasting must be free to all who can buy a receiver and string an aerial. They predict the time when a "Hasher" will render the messages quite unintelligible to those who do not lease a highly special and complicated automatic "decoder," which shall straighten out the jumble and give to the privileged listener the original voice or music. I say that such a system for *broadcasting* will never be employed. As well wish that newspapers were printed in such type as to be unreadable except through highly complicated and expensive glasses; or that a band concert might be unmusical except to those who were able to buy special ear trumpets!

Who owns the air or the ether anyway? Surely not any radio trust. Strict Govern-



Two Stages—1300 Miles—Says Mr. Emigh

It Makes the Loop Aerial Available to All

We know that our Cotoco Amplifying Transformer for Radio Frequency is scientifically right. We have been more than pleased by our own experimental successes. But we have waited to be sure. Now that actual users are duplicating our work we say

Buy Your Radio by the Name

Cotoco

TRADE MARK REG. U. S. PAT. OFF.

and Get Results Like These

(An Unsolicited Letter of Appreciation)

Gentlemen:—Am sending in a few results obtained since I started to use Coto-Coil Radio Frequency Amplifying Transformers type 5000.

Week of June 19 to 25 nineteen broadcasting stations received and positively identified, twelve on one evening. Using 3 stages Radio Frequency (Cotoco), detector and two step Audio with 5 foot loop aerial. Stations from 30 to 975 miles.

On May 16 listened to a concert by W.R.R., Dallas, Texas, 1300 miles, using 2 stages R. F. (Cotoco). Would be glad to recommend these transformers to anyone. Yours very truly,

PHILIP N. EMIGH, Box 37, Indian Creek, Pa.

P. S.—Static is practically unknown now and so is interference or jamming.

Other Cotoco products are Amplifying Transformers for Audio Frequency, Variable Air Condensers, and Honeycomb Coils; Free Loop Aerial Connection Diagram if you will send Dealer's Name.

COTO COIL COMPANY 87 WILLARD AVE. PROVIDENCE, R. I.

HEAD SETS

"Ampl-Tone"

$8.00 List 2200 Ohms Guaranteed

Sensitive and Durable

We Can Make Delivery
Our Only Product

FRENCH MFG. CO.

1931 BROADWAY NEW YORK

Write Us for Distribution

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GALENA ALL SENSITIVE GALENA CRYSTAL

Every Crystal Guaranteed Perfect and ALL-Sensitive

Galena Crystal, Mounted..... 35c
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Manufacturers, Jobbers, Dealers, write for quantity prices.

GALENA CRYSTAL MFG. CO.

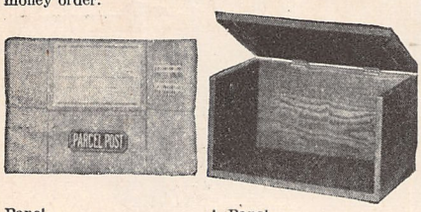
464 Bushwick Ave. Brooklyn, N. Y.

MONEY for You—Add to your Salary—Make extra Pin Money. Start a lucrative business of your own. Spend an hour each day taking subscriptions for the "Radio News." We'll pay you well and you'll enjoy the work. Write for full particulars. Circulation Dept., **RADIO NEWS** **53 Park Place, N.Y.C.**

We Save You Money on

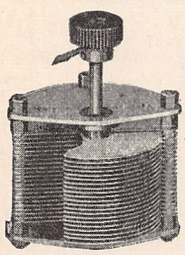
RADIO CABINETS

Assemble your set in one of these handsome cabinets equal in appearance to the most expensive, yet priced unbelievably low. Everyone can afford them. A necessary protection against dirt, dust and atmosphere. Made of selected Oak, splined cover, will not warp; shipped knocked down, with full instructions for easy assembling and staining. Order today, cash or money order.



Panel Size	Price	Panel Size	Price
6x7"	$1.50	9x14"	$2.75
6x10½"	2.00	12x14"	3.25
6x14"	2.00	12x21"	3.65
6x21"	2.50		

All Cabinets 7 inches deep inside



VARIABLE CONDENSERS

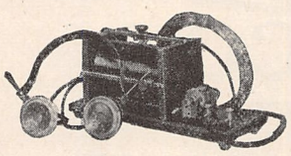
Exceptionally efficient. Very compact. .061 Spacers. Aluminum plates, brass optional. Additional plates upon application.

43 PLATES, .001 Assembled $5.25

23 PLATES, .0005 Assembled $4.35

RADIO SET

$3.95



Parcel Post Order Today

Equal to sets at several times the price. Dust-proof Detector, Insulated Sliders. Coil wound, parts machined and finished. Neat. Shipped knock down with instructions for easy assembling. Aerial wire included.

Above Set With Double Phones $9.65

Above described Receiving Set with Double Head Phones, complete, ready to listen in.

Double Head Phones, Separately $5.75

Radio Cabinet Co. of Detroit 1460 Hubbard Ave. Detroit, Mich.

ATTENTION Radio Manufacturers!

We have a complete organization and all modern factory equipment for the efficient making of

High-Grade Woodwork for Wireless

Handsome mohogany or quarter-sawed oak cabinets, boxes, panels, mountings and bases, rotors, stators, etc.

Submit your requirements and we will promptly quote attractive prices.

THE PILLIOD LUMBER CO.

DEPT. "R" SWANTON, OHIO

JORGOTONE RECEIVING SETS

IDEAL SETS FOR "VACATION LAND"

Send for Bulletin RN

JOHN JORGENSEN COMPANY, INC.

120 LIBERTY STREET NEW YORK

ment regulation of broadcasting, wavelengths and power and time schedule is of course necessary for the good of all (already the amateur who would rather talk or play his phonograph than listen is becoming a pestiferous nuisance). But those who would in any way limit the number who should derive benefit from the entertainment and instruction which can be distributed through the ether are the worst enemies of broadcasting; still more important, they are no friends of the public.

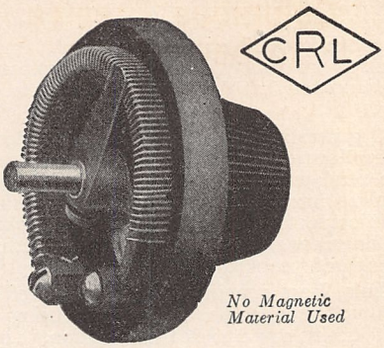
Let us not forget the ether is to become the means of uniting all our people, all sections of our country, and later all countries—to a degree which not the printed newspaper, the telegraph, or the telephone could ever attain. Thank God that the Hertzian waves know no barriers of man's making, no State or national boundaries. Those who are commercially empowered to use this universal medium as a distributing means, must not look to the millions of listeners for their reward, save as the disposal of receiving equipment and renewal parts can (abundantly) reimburse them. Aside from this, they have a public duty to discharge, and if their directors are too small-minded to appreciate the privilege they hereby enjoy, then our Government must itself take up this work of broadcasting to all its citizens, without discrimination, the news and amusement, the education which this unparalleled institution now makes possible. Such radio distribution is of infinitely more value than the governmental institution of seeds—or of congressional speeches!

For long distance commercial radio telephony, where secrecy is as necessary as over a wire, some means of rendering the message unintelligible except to the proper receiving station is of course necessary. This will come into use, and some day, not too far distant, such form of radiophone messages will be transmitted across oceans, possibly also across continents, in connection with wire distribution at either end, as we already see it in use between Catalina Island and Los Angeles and the rest of the United States. But radio broadcasting must not be secret. It must be kept as free as air—and as clean and pure as air.

With such manifold, heretofore undreamed of blessings at hand; with such an opportunity of cementing the people of a nation; with such an instrument of public service awaiting an application to our daily lives, little wonder the spell of the radio, the surpassing fascination of its mystery, "gets us" all, young and old; and its message, if varied, entertaining and educative, will never grow monotonous, or irksome, or commonplace. And, therefore, I am certain that we are beginning now a new era in our national life. That it will be easier, in future, to work and be contented, to look forward through each day's toil to relaxation and refreshment, and education by twilight or lamplight, and that this change in the life in the city and on the farm will work a profound change in our national life. *Yes*, a thousand times *YES*. For the radiophone is no longer a school boy's toy; at once it is a household necessity. Around, above every house, every apartment, surges a silent sea of voices, of wisdom for the old, of amusement for the young, of song for the gay, of cheer for the lonely. Who then so unimaginative as not to string his Æolian harp to vibrate to these speeding waves, to tune to the message he likes best to hear?

TWO NEW SIGNAL CORPS STATIONS

The opening of new Signal Corps radio stations at Fort Bennings, Ga., and Fort Totten, New York, brings its total stations to 53, and with the cooperation of the Naval Station at Boston, one more point is reached. A new station planned for Fort Sill, Oklahoma, will hook the Eighth Corps Area into the Army Radio Net, which will then embrace practically the whole country.



No Magnetic Material Used

SMOOTH, QUIET CONTACT

Perfect step-by-step action—no stubbing. These are distinctive features of C. R. L. No. 100 Filament Rheostats. The contact shoe is broad and flat with edges turned up. Each turn of the resister wire is anchored securely. Noisy or scratchy operation is impossible.

Price at Your Dealer's

(East of Rocky Mountains)

$1.00; by mail, $1.10

Dealers and manufacturers of Radio Equipment are invited to write for quantity discounts.

Immediate Shipments

Central Radio Laboratories

303 16th Street

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ELECTRICITY Needs YOU

It's a shame for you to work for less than $100.00 a week when Electricity needs you and will pay you big after you are trained. Ordinary screw driver electricians are plentiful but trained men—Electrical Experts—are scarce.

Earn $3500 to $10000 Yearly

Be an Electrical Expert

Earn $70 to $200 a week. You can do it. I will show you the way. Experience or education unnecessary. Write me today. Let me send you my big Electrical Book, Proof Lessons, Free Electrical Outfit Offer, particulars of my Free Employment and Consulting privileges and my Guarantee Cash Bond—all Free and without obligation on your part.

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Chicago Engineering Works
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Let Me Train You At Home Now

NEW ORLEANS RADIO APPARATUS and SUPPLIES

ROSE RADIO SUPPLY

129 Camp St., New Orleans, La.

Send 10c for Latest Catalog

Columbus Theatre to have Radio

(*Continued from page 439*)

programs offered by broadcasting stations and the fact that Columbus is so situated that a number of large stations "come through" satisfactorily, the patrons of the theater are looking forward to the plan with decided interest.

There are two angles to the proposition, however, that are attracting more interest in the amusement world than that of the idea of furnishing radio music to concert players. The first is the attitude of the musicians' union toward the plan. The Hartman Theater has been operating with union musicians. Whether they will object to being shoved aside during the summer months to be recalled for the regular productions in the winter is a matter of conjecture. It is hinted by the management, however, that should the radio station live up to expectations, an orchestra may not be needed except for musical productions which carry their own musicians.

The second angle is whether the distribution of concerts in a legitimate theater by radio will not bring a "kick" from the various performers who have been donating their services at broadcasting plants. These performers, it is pointed out, may object to a plan which might eventually reduce the demand for their talent in the theaters and for this reason decline to give further radio demonstrations. It is also pointed out that the performers generally are organized into unions which work in close harmony with the musicians' union.

In any event the management of the Hartman has announced its determination to proceed with the plan, the outcome of which will be awaited with interest.

Radiophone Broadcasting in France

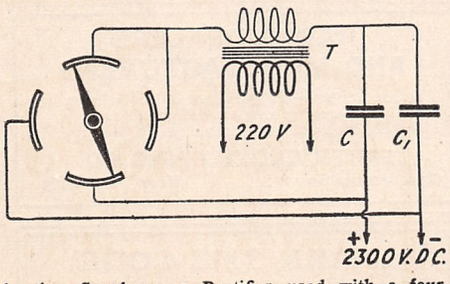
(*Continued from page 432*)

generative type, with detector and two-step amplifier, the aerial being 45' long.

In Algeria, at 1,500 miles, the speech is very good and very loud, with a four-stage radio frequency amplifier, with an aerial of the fan type supported by two masts 100' high. At last, in Holland, at 300 miles, another amateur receives all the transmissions regularly with a four-wire aerial 75' long, 12' above the roof, with a regenerative receiver and one tube. This shows the efficiency of this radiophone broadcasting station, which is constantly being improved.

LOUD TALKER RECEPTION

The loud talkers being used over there are somewhat of a novel type and the members of the Signal Corps of the French

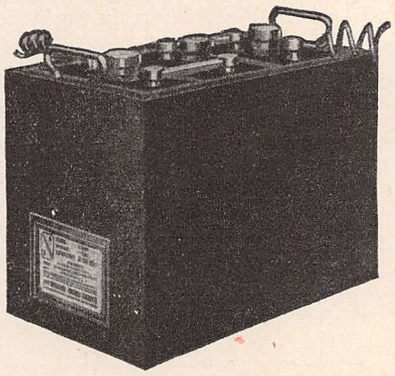


Another Synchronous Rectifier used with a four pole motor

Army have tried to utilize tuned telephone receivers, responding to the various frequencies of the voice and music. Fig. 4 shows a complete receiving set with loop

To Get the Most from Your Radio Set Use "A" and "B"

WESTINGHOUSE RADIO BATTERIES

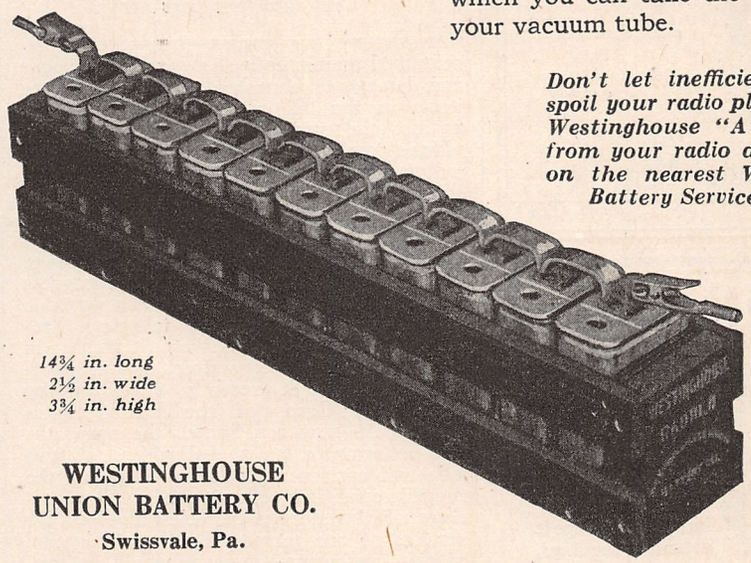


"The best Westinghouse can build"

The Westinghouse "A" is a special radio battery, made with a heavy plate and separator to insure long life. It furnishes just the type of strong, steady, constant current of low voltage that radio reception needs. It will stand continuous use without getting "tired."

The Westinghouse "B" is the best answer yet found for "B" battery problems. With occasional recharging it will be constantly full of energy and will last indefinitely.

It is noiseless, clarifies the signals, does not polarize. Its adjustable contact gives adjustable voltage by which you can take the howl out of your vacuum tube.

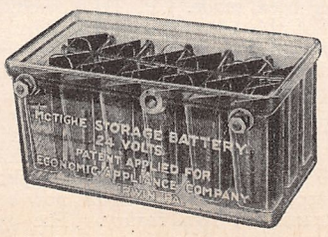


14¾ in. long
2½ in. wide
3¾ in. high

Don't let inefficient batteries spoil your radio pleasure. Get Westinghouse "A" and "B" from your radio dealer or call on the nearest Westinghouse Battery Service Station.

WESTINGHOUSE UNION BATTERY CO.
Swissvale, Pa.

McTIGHE ALKALINE STORAGE "B" BATTERY
for RADIO OUTFITS



This month the McTighe Storage "B" Battery makes its appearance in an attractive oblong glass container of the unit construction type.

It is the most satisfactory 22-volt "B" Battery—is inexpensive, noiseless; cannot be damaged by short circuit, overcharging, standing idle or uncharged. Can be fully charged from any light socket for less than one cent.

The McTighe Rectifier is cheap, simple, durable and effective, and should be used when charging the McTighe Battery. **Battery, $5.00; Rectifier, $1.50; Rubber Filler, 25c.**

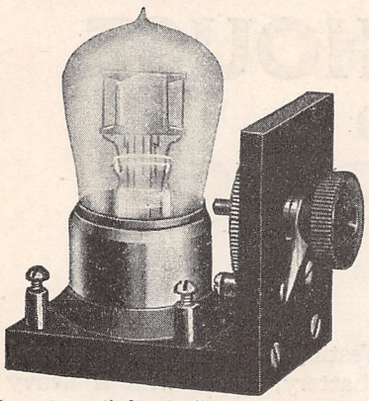
F. O. B. Irwin, Pa. *Discount to dealers.*

ECONOMIC APPLIANCE CO.
IRWIN, PENNA.

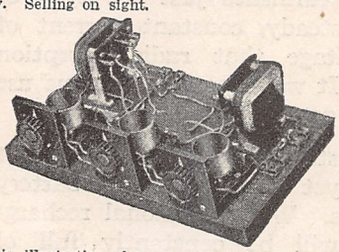
PRECEL TOLEDO

Audion Control Unit

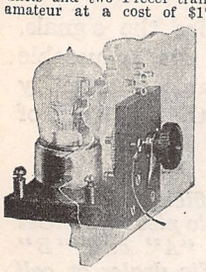
The Hit of the Year



Compact, practical and efficient. For table or panel mounting. Moulded hard rubber. Rheostat 6 ohms resistance—2 amps. carrying capacity. Selling on sight.



This illustration shows a detector and two step amplifier using three Precel audion control units and two Precel transformers. Built by an amateur at a cost of $17.00.



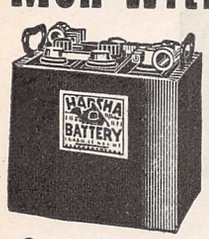
Phantom view showing Precel audion control unit mounted back of panel with but two screws.

Write for literature and prices

Precel Radio Mfg. Co.

1055 Spitzer Bldg. Toledo, Ohio

Men With Radios Wanted



to introduce and take orders for our NEW PROCESS STORAGE BATTERY. Plates cannot sulphate or buckle. No expert attention required. One-half cup water every 3 months. Made for autos, radios, lighting outfits and all other battery purposes.

Guaranteed 2 Years

The biggest money maker and greatest business builder ever known. Write today for our exclusive proposition and low wholesale prices.

HARSHA BATTERY CO. Dept. 28
19 East Van Buren St. CHICAGO

RADIO DIAGRAMS

20 BEST "HOOK-UPS"

16 Receiving—4 Sending

Explanatory Notes—Symbol Sheet—Glossary
Fire Insurance Rules
In Detachable Loose Leaf Form

by F. J. GILLOON, formerly Instructor Cal. Inst. Tech.

50c Everywhere—From dealers or by mail.

THE TRIANGLE CO., 539 N. Los Robles Ave., Pasadena, Calif.

aerial and amplifier, with, in front of the table, the loud speakers consisting of 12 telephones fixed at the end of hexagonal tubes mounted in a block with plaster around and between to prevent the vibrations of the horns.

The received currents are first amplified and detected in the usual way; they are then amplified at audio frequency by a special amplifier having one tube in the first stage, three tubes in parallel in the second stage and in the third, 12 groups of three tubes in parallel, each group supplying a receiver. This disposition permits the tuning of each telephone, while if they were all mounted in parallel, some reaction would occur, making the system very difficult to adjust. With 240 volts on the plate, the current is about 200 milliamperes and may decrease during a strong reception down to 100 milliamperes.

The results obtained with the system described above have been excellent in auditoriums and large theatres where it was possible to entertain a few thousand people with radio music. Fig. 5 shows the hook-up of the amplifier used in these experiments.

This method of production of very large volumes of sound is undoubtedly a good one, and it would be interesting to try it with Baldwin phones, or other mica diaphragm receivers mounted on larger horns, each telephone being adjusted for a particular range of frequencies.

It is expected that during next fall, regular concerts will also be transmitted from the other radio station at Ste. Assise, making it possible for the radio enthusiasts to pick up some music or news during several hours each day.

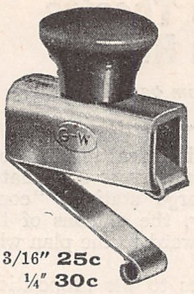
Discarding Storage Batteries

(*Continued from page 441*)

contained therein both as a source of danger and damage to household or office, are the items in the bill of indictment preferred against the storage battery. Some individuals would go so far as to issue a blanket indictment against this source of electric strength as being responsible for retarding the unrestrained development of the radio-telephone as a household utility.

The bulkiness and weight of the storage battery, assuredly, have retarded progress in the direction of compactness in portable radio-telephone and radio-telegraph receiving outfits. A striking example in the mind of the writer is a portable wireless set recently developed by the Signal Corps of the United States Army. As now constituted, the apparatus can be strapped on the shoulders of two men and carried afield, irrespective of the rugged conditions encountered. The carriage of the storage batteries involves the services of one person. By the elimination of this cumbersome unit, it would be possible for one man to transport this equipment from place to place.

The electron-tube amplifier described in this article may, or may not, signify the elimination of storage batteries. The Bureau of Standards admits that its progeny is in an experimental stage. Anyway, a start has been made. P. D. Lowell, the inventor of this electron-tube amplifier, has a predilection for designing wireless units neat and compact in formation. He conceived the idea of converting a common suitcase into a complete radio-receiving outfit, which original conception was first described by this writer in RADIO NEWS of September, 1921. "Radio in a Suit-Case," is a phrase that is fascinating and the idea is now being widely translated into reality. The germ of this compact radio formation had its inception with P. D. Lowell of the Radio Section of the Bureau of Standards.



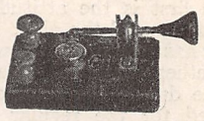
3/16" 25c
¼" 30c

G-W Slider

Famous Leader of a Line of Quality Standard Radio Products

Ask for G-W Radio Products

Crystal Detectors
Receiving Sets
Aerial Insulators
2 Slide Tuners
Unmounted Coils



Distributors Write

GEHMAN & WEINERT
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NEWARK, N. J.

AUTH

Supersensitive Phones 2200 ohms, list price $8.00

To get the best results from your set use AUTH Phones

VARIABLE CONDENSERS

11-23-43 Plate
List $2.75—$3.25—$4.00

These are variable condensers that are highly efficient and exceedingly well made.

Dealers Write for Attractive Proposition!

RADIO DEPARTMENT OF

SIGNAL SYSTEMS SERVICE CO.

1 E. 42d St., NEW YORK CITY

WANTED Reliable JOBBERS for our bakelike variocouplers. Double green silk covered wire wound securely upon a moulded stator and rotor tapped so as to obtain a one-turn variation over its entire range. No shellac used!

$5.00 Attractive discounts to dealers and jobbers

Ridgewood Radio Shop

1603 Myrtle Ave. Ridgewood, L. I.

RADIO DEALERS AND MANUFACTURERS

We have them—all parts needed for the radio trade promptly delivered.
Send us your requirements for prices

SMITH ENGINEERING CO.

One Union Square New York City

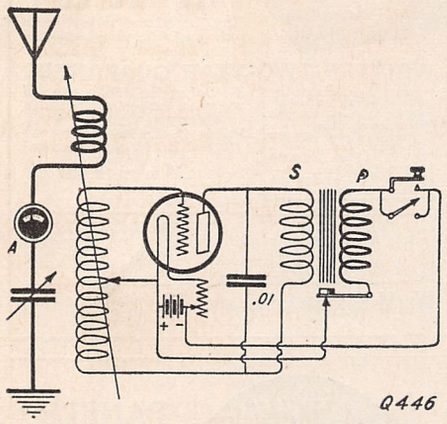
LEARN THE CODE

There is more to radio than "Concerts." Get the intelligence being broadcasted by code. Skilled operators in demand. Wonderful new method makes code simple as listening. Clear, concise, complete. Nothing to unlearn. Positively easiest system. Worth many times the price. Sent complete with full instructions, One Dollar.

F. L. BILLINGHAM, 208 Eighth Ave., Brooklyn, N. Y.

I Want to Know

(Continued from page 469)



Loose Coupling is Employed in the ICW Sending Set Above. The Plate Power is Supplied by a Small Spark Coil.

WESTINGHOUSE DRY CELL V. T.'s

(459) L. K. Van Tandingham, El Paso, Texas, wants to know:

Q. 1. Can the Westinghouse tubes operating on a single cell be used as amplifiers, both audio and radio?

A. 1. The Westinghouse tubes may be used for either radio or audio frequency amplification.

Q. 2. Are special transformers required?

A. 2. No. The only apparatus which is different is the socket. It will be necessary to especially construct these.

DETECTOR TUBE AS AUDIO AMPLIFIER

(460) Edward Oerly of Pilot Grove, Mo., wants to know:

Q. 1. What is the wave length of the set described on page 938 of the April-May issue?

A. 1. The range is about 175 to 500 meters depending upon the type of apparatus.

Q. 2. Will a U. V. 200 detector be suitable for amplifying also?

A. 2. It is possible to use a U. V. 200 for amplification purposes but much better results will be obtained with hard tubes intended to be used as amplifiers. A low voltage must be used on a soft tube.

ELECTROLYTIC RECTIFIER

(461) Leonard Olmstead, of New Britain, Conn., requests:

Q. 1. What size plate should be used for a single cell rectifier to charge a six volt battery at a two amp. rate, using 110 A.C.?

A. 1. The plate may be 1" wide and 8" deep. It will be necessary to have two 100-watt lamps in bank form and in series with the rectifier and battery to pass almost two amp.

Q. 2. Could this rectifier be used to charge a storage B battery?

A. 2. Yes. It will be better, however, to charge the B battery at a slower rate. Question 406 of the July, 1922, issue of RADIO NEWS gives a more efficient diagram for a battery charger, using four electrolytic jars.

COILS FOR 360 METER RECEPTION

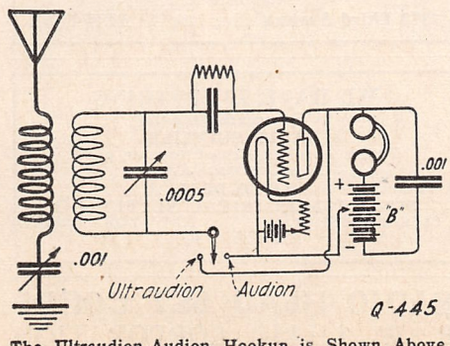
(462) Mr. Otis Jett, Richmond, Ky., writes:

Q. 1. What coils should I use in a regular 2-coil mounting for receiving radiophone stations on 360 meters?

A. 1. The proper coils to use for reception of 360 meters are: For the Primary L75, for the secondary L35 and for the tickler L50 or 75.

Q. 2. Why will my receiver, which is hooked up with tickler coil, not regenerate?

A. 2. Perhaps the leads to the tickler are incorrect. Try reversing them. Reverse the storage battery leads also.



The Ultraudion-Audion Hookup is Shown Above. A Single Pole Double-Throw Switch Changes the Circuit.

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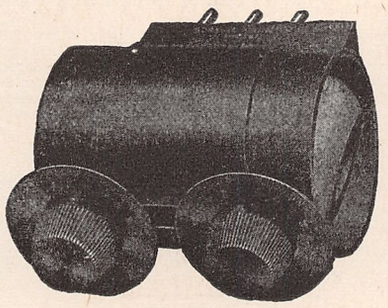

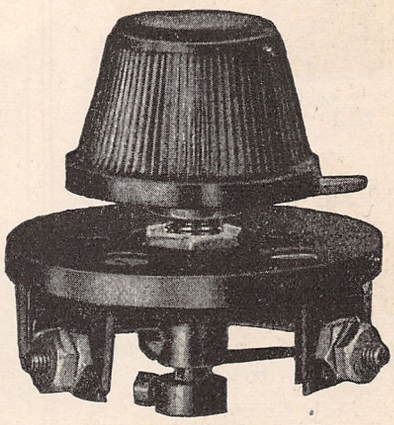

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Model B

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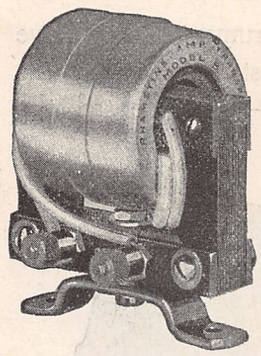

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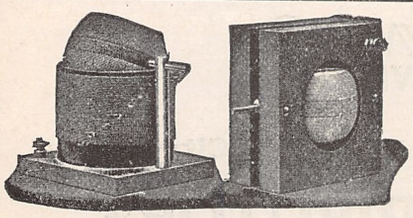

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A. C. FOR FILAMENT HEATING

(463) James Brady, Oregon City, Oregon, wants to know:

Q. 1. Can a regenerative hookup be employed when using A. C. on the filament of the detector tube?

A. 1. Yes. It will help to eliminate the A. C. hum when adjusted properly.

Q. 2. Is an A Battery potentiometer suitable for use in the circuit on page 447, January 1921 issue?

A. 2. Yes. This potentiometer should have a resistance of from 200 to 400 ohms.

GROUND IN SWAMP

(464) C. S. Cobb of Toronto, Canada, asks:

Q. 1. What is the hookup of the vacuum tube set described on page 951 of the April-May issue?

A. 1. The hookup may be the same as the ordinary honeycomb coil set.

Q. 2. How many turns on primary and secondary and tickler?

A. 2. You may put 40 turns on the primary, 35 on the secondary and 50 on the tickler.

Q. 3. How may I obtain a good ground in a swamp?

A. 3. Lay a 100′ wire under the aerial and have it enter as many pools as possible. The wire may be No. 18 or heavier, bare copper.

FINE TUNING WITH HONEYCOMB COILS

(465) L. Parker of Detroit, Michigan, writes.

Q. 1. Can fine tuning be accomplished with a honeycomb receiver?

A. 1. Very close tuning can be had with honeycomb coils after the knack of handling them is learned.

Q. 2. What range is to be expected with a crystal receiving set?

A. 2. The distance which can be covered depends on the power of the transmitting set and other variable factors. A station like KDKA in Pittsburgh, Pa., may be heard with crystal over a range of 30 miles.

Q. 3. What is meant by saying a receiving set is "sharp?"

A. 3. A transmitting set is called "sharp" when the emitted wave is sharp; i. e., limited to a certain wave and not audible on any other close by. A receiving set is selective, not sharp, when there is no interference in reception caused by another station sending on almost the same wave length as the station it is desired to receive.

RADIO FREQUENCY AMPLIFIER

(466) Frank Holetsky, Uniontown, Pa., requests:

Q. 1. Can I add a two step radio frequency amplifier to the set described on page 960 of April-May issue of RADIO NEWS?

A. 1. This circuit was published in the "I-Want-To-Know" column, question 403 of the July, 1922, issue of RADIO NEWS.

PATENTS

(467) J. Gillen of Brittan, Okla., wishes to know:

Q. 1. Would I be infringing on patents if I construct and sell radio sets?

A. 1. If the circuit is patented you will be infringing on the rights of the inventor. You will have to obtain permission and a license to sell the sets but may construct them for your own use without permission.

The Detective Detector

(*Continued from page* 447)

The day seemed to drag along at a snail's pace, but evening finally came.

He recalled the positions of his dials in getting the thrilling monologue and he tuned for it again.

A slight adjustment would bring in the church services broadcasted at KDKA, but he was after something better and he tuned it out again.

He sat up most of the night watching closely for the Frenchman to start up, but was disappointed.

At four he gave it up and climbed into bed.

According to his orders, he was called in the morning at seven. Dressing hastily he packed up his grips and descended for breakfast.

To his surprise he saw another salesman from his company. He was enjoying a fearfully large dish of bacon and eggs.

"Hello, Howard," he said, "you now behold a man of leisure—that is for two weeks. I am taking some time off to run over home for the holidays."

Howard ordered his breakfast to be served at his friend's table. His friend, Ray Barnard, it seemed, was driving to Columbus to be at home for Christmas, for the first time in six years.

As he was driving through he offered to take Hagen as far as Zanesville.

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Wheeling to Columbus will recall the "S" bridges which are found between Cambridge and Zanesville.

As our two friends were passing over one of the tortuous "S" bridges they noticed that one side of the concrete-and-stone parapet was torn away. In a ditch, just beyond this, lay the fragments of a chair.

Hagen, feeling that here was some evidence, asked his friend to stop the car.

His friend, rather perplexed, complied.

Some children were engaged in picking up and fitting together the fragments of the chair.

He asked them what had happened.

They replied that a "great big wagon" had slipped on the icy road and had crashed into the brige. This happened Sunday afternoon.

The van was no doubt on its way to Zanesville when this happened.

As they continued on their way Hagen told Barnard about the robbery and his accidental listening-in on some directions.

"I'd give anything to see the inside of that van," said Hagen soberly, "I have an idea that we would find a neat little transmitting plant."

Barnard thrilled at the story. "Just think, you could follow it up and get the three thousand."

"Would you care to stop over in Zanesville tonight with me?" asked Hagen. "We could drive around and look for the van."

Barnard thought he would.

They arrived in Zanesville early enough to register at the hotel and take in the city before dinner.

Zanesville is situated at the junction of two rivers across each of which is a dam just at the junction, so built as to give the appearance of being one continuous dam. One old flour mill is still standing, primarily designed to utilize the water power of the dam, but now grown beyond the capacity of the dam's hydraulic head. They were interested in several of these landmarks and drove around the city with the air of sightseers. The thing which would have set them in ecstasies, however, was a rambling old motor-van.

They drove around for an hour looking in vain for the van; they decided to go back for dinner and then try their luck that afternoon.

During lunch the robbery and robbers were the sole topic of conversation. Howard was careful to see that they talked guardedly, as it wouldn't do for them to give themselves away.

After lunch they made a hasty trip around the lower end of town. Just as they turned to go back, Howard grabbed Barnard's arm, excitedly.

There in a driveway, leading from the street past a house and back to a large barn was a van.

Barnard looked inquiringly at Hagen, who was so excited he could hardly speak.

"Barney, ol' boy," he managed to say, "I think we're in luck. Do you see that crushed fender on the rear?"

Though inwardly excited they managed to drive by the place calmly enough.

"What shall we do?" questioned Barnard.

"I have it all worked out," announced Hagen, feeling like a young Pinkerton. "Did you notice that the woman in the house next door keeps roomers?"

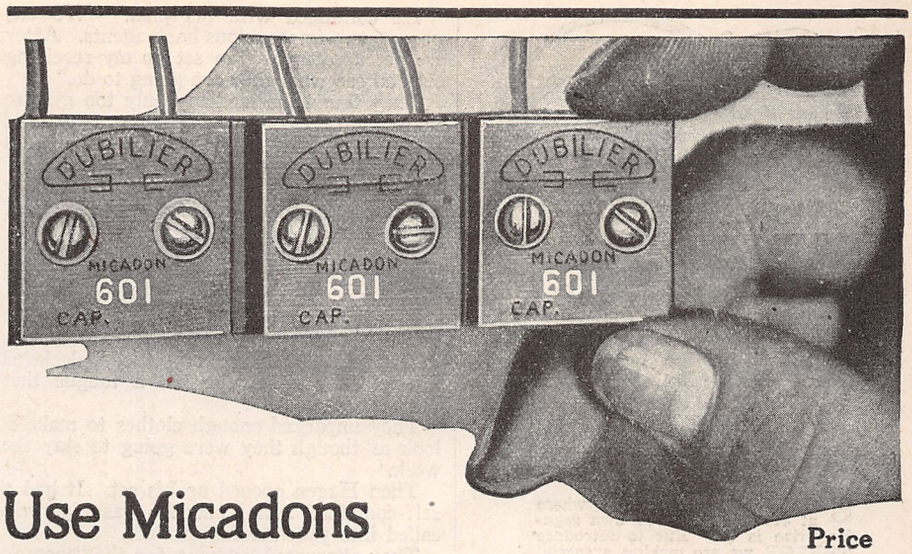
"Why, no, I was too excited to notice that."

"Well, we are going to put on some older clothes and take a room there." Hagen spoke calmly and with the air of a man who has thoroughly planned his campaign.

They returned to the hotel and put on ordinary clothes. They checked the rest of their luggage and left the hotel.

"What sort of disguise should we use?" asked Barnard.

"Let's use our actions for a disguise," replied Hagen.



Use Micadons 601 Like Building Blocks

Price 35c each

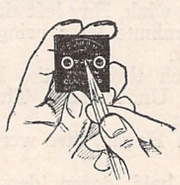
Dubilier Micadon Type 601, here shown full size, has the same perfect mica insulation, the permanent capacity that has always characterized the famous larger, Dubilier mica condenser, which is the standard equipment of 95% of the governments and radio companies of the world.

Dubilier Micadon Type 601 is a little larger than a postage stamp. Use Micadons Type 601 to build up any capacity as if they were building blocks. Simply connect them in series or parallel. Buy Micadons by the dozen and keep them on hand.

Dubilier Micadon Type 601 insures perfect broadcasting reception. Because the condenser layers are *pressed* together they cannot dilate and contract with the oscillations of current in the antenna. Hence the capacity cannot vary, and there can be no tube "howls" and noises due to fluctuations of capacity.

Price 35 cents each for capacities .0001 to .0005 mfd.; by the dozen $4.00. Price 40 cents each for capacities .001, .002, and .0025 mfd.; by the dozen $4.50.

Make Your Own Grid-Leak With A Lead Pencil



Sandpaper the surface of Dubilier Micadon Type 601 between the terminals. Next rub the point of a black lead pencil over the roughened surface as here shown. To adjust the grid-leak thus made rub away as much of the graphite that has been deposited as may be necessary. Every tube should have an *adjusted* grid-leak, and this is the way to make one simply and cheaply.

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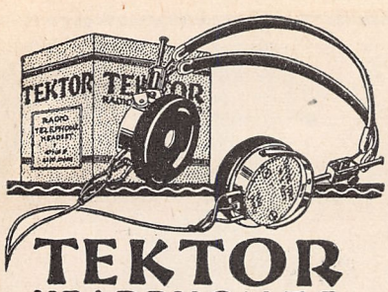

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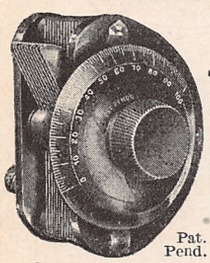

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He continued with his plan. "We can pose as two impecunious book agents. After we get a room we can set up my receiving set and see what they are going to do."

They found the landlady only too glad to take additional roomers. She apologized for the room she had to show them—it was a back-room and——

But when they saw it gave a direct view of the house in which they were interested they promptly stopped her apologies.

They told her they would take it for one week, paying in advance, because they did not know how well their goods would sell.

The landlady seemed satisfied with their explanations.

"I'm glad we have her settled," declared Hagen, "for I bet she has a tongue that could wag."

They unpacked enough clothes to make it look as though they were going to stay the week.

Then Hagen opened up his set. It had a self-contained aerial and the gas pipe was called into play for his ground.

They alternated listening for the "enemy's signals" for about an hour, but nothing came in.

They raised the shade of the window facing the suspected house and pulled the bed to a position which would enable them to lie on the bed and still keep the house within their vision.

Just at dusk two men were seen carrying some heavy articles to the van.

On the instant Hagen was at his set, waiting.

For fully forty-five minutes nothing was heard.

Then, and Hagen almost gave a war-whoop, the voice started its monologue again.

Hagen copied down, as well as he could, the odd message.

He shoved a page of his writing over to Ray, but Ray looked at it blankly.

"It's French, Ray," laughed Hagen, "I'll translate it when he's through."

He was talking about *"ce soir"*—"tonight." Hagen adjusted the receivers closer to his ears.

"We will have about the same radius, tonight," Hagen translated. "We will try it out once again just before visiting Bain's."

Hagen translated all of this to his friend. "If we knew what they meant by 'Bain's' we could put the police on their trail," mused Hagen.

With a knowing wink, Ray left the room.

He appeared a minute later bringing the telephone directory.

A hurried search through the B's disclosed A. B. Bain, Undertaker. They were off the track again.

"Hurrah!" cried Hagen, "we weren't far off; it is Bayne."

There with a half dozen departments listed was Baynes, Fur Importer.

They jumped in the car and were soon downtown. It did not take them long to discover the handsome building of Bayne's.

On Hagen's advice, they went to see the chief of police.

Hagen told that they had proof that the same people who made the rich haul at Cambridge the last Saturday night were planning to repeat their efforts at Bayne's tonight.

Their earnestness soon convinced the chief.

"We won't know their appointed time until they start," declared Hagen, "but we can let you know when they do."

Hagen outlined a plan which he had in mind and the chief accepted it, approvingly. "We could use a man like you on our staff," he said, admiringly.

Hagen modestly said that he was just unusually interested and that he had had a lot of time to think it out.

* * * * *

They could hardly eat any supper for their excitement.

On returning to their room Hagen tuned in several different concerts.

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Grewal "always adjusted" crystal detector	2.00
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23 Plate Variable Condenser	4.25
Federal Jr. Crystal Set, Complete with Phones	25.00

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"Just to quiet our nerves," he explained, "they won't do anything until late tonight."

"They" meant the robbers, of course.

The evening radio-programs were over entirely too soon and Hagen amused himself trying to take down some of the spark messages.

The hours passed slowly. Then there was a disturbance next door, and they were on the alert instantly. True to their plans, they tried out their phone.

About two o'clock in the morning the van lumbered noisily away. Hagen and his friend packed the receiving outfit and made for the station.

A report soon came in that a van was "repairing a tire" just opposite Bayne's.

According to Hagen's plan, they, together with a dozen stalwart policemen, climbed into a patrol wagon.

They went clanging down the main street, passed the van opposite Bayne's and continued down the street.

"That will make them feel safer," grinned the chief; "they'll think we are going out of town on a raid."

What the van passengers did not know was that the patrol turned around a few blocks down the street and quietly made its way up an adjoining street.

When they reached a point just around the corner from Bayne's they stopped and Hagen set up his outfit.

True to form, the instructions were being transmitted. "The cops have gone out on a party," the voice gloated, "so take your time."

The man on watch reported that the driver had rolled a tire down to an air station a block away.

This gave the police an opportunity of rushing up on the van. A detachment was sent down the street to apprehend the driver.

From the rear the van looked very unsuspicious; evidence of an ordinary household cargo was noticeable.

Four men, including Hagen, quickly climbed up in the driver's seat. There, just behind the seat, sat a man at an instrument board, with a microphone in his hand.

He was so completely surprised that before he could give warning over the phone it was knocked out of his hand and he was overpowered.

Hagen seized the microphone and imitating the other man's voice, urged them, in French, to bring out the goods.

In a short while four men came out, staggering under large bundles.

As the policemen had concealed themselves in the van, the thieves came up to the van without being suspicious.

With a cry of "Stick them up!" the cops sprang out. Their surprise and chagrin were intense. One fellow continued to hold his bundles.

They were promptly handcuffed and led away to the patrol. The cops came back up the street with the still protesting driver, but when he saw the other five were prisoners, he became silent.

Carrying out the rest of Hagen's plan, they took the van with a half-dozen policemen and drove out to the robbers' abode. As they turned in at the driveway, two women came out to meet them.

These women were promptly arrested.

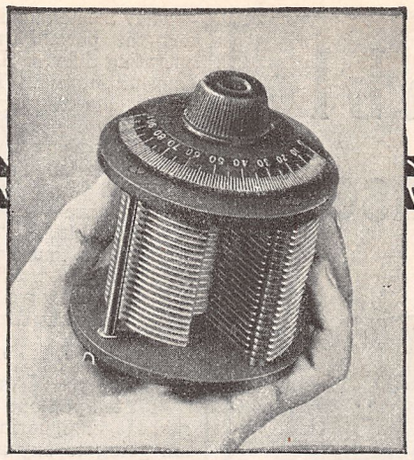
A careful search of the house disclosed huge quantities of silver and jewels, as well as a large stock of clothing.

All of this was placed in the van, after the camouflage of furniture had been removed, and carried to the station.

The chief was highly elated. He shook hands warmly with both Hagen and Barnard, promising to see that they received "all" the rewards. "These men have been working a large section of the country and there are rewards offered in several cities for their detection."

"Detected by a Radiotron," punned Hagen.

The chief looked blank until Hagen explained the use of the tube.



The Westwyre Condenser

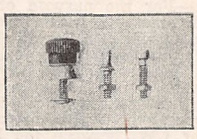
The Sliding Beamweight of Your Radio Set

THE Westwyre Variable Condenser acts for a radio set as a sliding beamweight does for a scale. The value of the Westwyre Variable Condenser comes through the fine adjustment of which it is capable. The inductance units may be relatively crude, yet the Westwyre Variable Condenser connected in series or in parallel with the inductance will serve as the finishing touch.

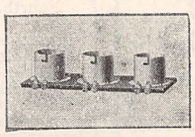
It is much like a weighing operation in which weights of several pounds are placed on the scale, while the delicate balancing is accomplished by a sliding beamweight. It is for this reason that in your radio set the inductance may be varied in rather large steps, while the finishing off, should be left to one or more Westwyre Variable Condensers which are capable of exceedingly fine wave length adjustment.

Westwyre Variable Condensers are constructed with micrometer exactness. Duralumin, the metal specified by the army and navy, is used both for the stationary and rotary plates. The top and bottom are of brown bakelite. Dial is of black moulded bakelite with one hundred graduations. For sale at your nearest radio and electrical shops or send money to the *Westwyre Radio Company, Westfield, Mass., U. S. A.*

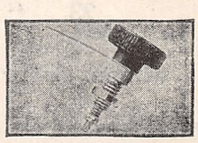
Westwyre Variable Condenser 43 plate, .001 mfd with dial.....$5.00
Westwyre Variable Condenser 23 plate, .0005 mfd with dial..... 4.00
Westwyre Variable Condenser 11 plate, .00025 mfd with dial..... 3.50
Westwyre Variable Condenser 3 plate, vernier with dial..... 3.00



Westwyre binding posts, contact points, etc., are sturdy, reliable products. Binding posts range from 8 to 10 cents apiece. Others proportionate to same high quality.



Westwyre, one, two and three Vacuum Tube Sockets are brass nickel plated, mounted on single insulated base with phosphor bronze contacts. Price, according to No. of Sockets, $1, $2, $3.



Westwyre Switch Lever, 1 in. composition knob, lever having 1¼ and 1½ in. radius: all parts nickelplated. Prices, $0.55 and $0.60, according to radius of lever.

Westwyre
Variable Condensers

AMRAD

The Recognized Symbol of Superior Performance

For Immediate Delivery

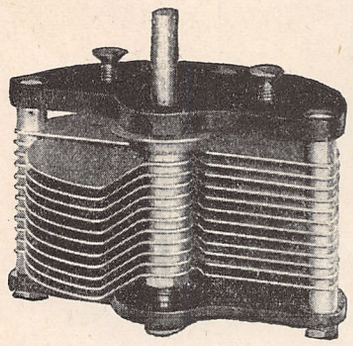
DISTRIBUTED BY

ELECTRIC SERVICE ENGINEERING CO.

105 West 47th Street **NEW YORK CITY**

Get a Handy Binder for your RADIO NEWS. Holds and preserves twelve issues, each of which can be inserted or removed at will. Price 65c. Experimenter Pub. Co., Inc., Book Dept., 53 Park Place, New York.

Variable Condensers



Variable Condensers to be efficient must be well made. Loose joints or faulty construction soon allows the plates to get out of alignment and decrease their efficiency.

A seasoned organization backed by a half million dollar equipment has placed the United Condensers in the front rank with radio engineers the country over.

Prices - 43 plate, $4.50
23 " 4.30
11 " 4.00
without dial or knob

Liberal discounts to jobbers and dealers.

We invite correspondence with Radio Manufacturers who are interested in using our facilities and services for manufacturing Radio Equipment.

UNITED MFG. AND DISTRIBUTING CO.
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GET THE BEST RESULTS FROM YOUR WIRELESS
USE
BRIGHT STAR
"B" BATTERIES
NOISELESS LONG SERVICE
LONG SHELF LIFE
BRIGHT STAR BATTERY CO.
New York Chicago San Francisco
310 Hudson St.–9 So. Clinton–Furniture Ex. Bldg.

"E. S. X." WIRELESS TALKING MACHINE ATTACHMENT
SILVER $8.00 GOLD $4.00
ESSEX WIRELESS SPECIALTY COMPANY
31 NEW STREET NEWARK, N. J.

They then examined the "outfit" of the van and the portable receiver carried by the operating thieves. It was a low-power C. W. transmitting set. The receiving set was a simple, portable crystal set with receivers fitted into a cap. They had evidently relied upon their short wave instrument as well as the French language to avoid detection.

"It was purely accidental that I was listening in at three o'clock last Sunday morning," exclaimed Hagen, "otherwise it might have been a long time until someone, who understood French, would have picked them up."

"What shall we do with our rewards?" asked Hagen as they went to their "rooming house."

"It's not 'ours'," protested Ray. "It all belongs to you; I was only a spectator."

"I'll tell you one thing I am going to get," said Hagen, ignoring his friend's protest. "I am going to buy a Magnavox and have it operate all night hereafter." He laughed and added: "The next time anybody uses radio for crooked business, it will come howling in and wake me up."

DAILY NAVY TRANSMISSIONS FOR AMATEURS DURING JUNE, 1922

First. English.—Commencing Saturday, June 3d, the radio amateur broadcast will be transmitted immediately after 9 p. m. press broadcast is completed, on 1,832 meters damped wave.

Second. English.—Commencing Saturday, June 3d, the radio amateur broadcast will be transmitted immediately after the 9 p. m. press broadcast is completed, on 1,832 meters damped wave.

Third. Following is list of new broadcasting stations: WEAD, Northwest Kansas Radio Supply Co., Atwood, Kan.; WEAE, Virginia Polytechnic Institute, Blacksburg, Va.; WDZI, Electric Supply Co., Wenatchee, Wash.; KDZJ, Excelsior Radio Co., Eugene, Ore.; WEAG, Nichols Hineline Bassett Laboratory, Edgewood, R. I.; WEAH, Wichita Board of Trade and Lander Radio, Wichita, Kan.; WEAI, Cornell University, Ithaca, N. Y.; WEAJ, University of South Dakota, Vermillion, S. Dak.; WDZK, Nevada Machinery and Electric Co., Reno, Nev.; KDZL, Rocky Mountain Radio Corporation, Ogden, Utah; KDZM, E. A. Hollingworth, Centralia, Wash.; WEAF, Western Electric Co., New York, N. Y.

Fourth. English.—For the purpose of getting in closer touch with amateurs within radio communication, this Bureau will establish an American Radio Relay League Traffic Station, call letters NAH, at the Naval Radio Station, Navy Yard, New York, in the near future. The apparatus will consist of a Western Electric type CW930 tube transmitter to be operated on 200 meters, using buzzer modulation or CW, between the hours of 11 p. m. and 4 a. m. daily.

Fifth. English.—Following is list of new broadcasting stations: KCZD, W. R. Mitchell, Los Angeles, Calif.; WDAV, Muskogee *Daily Phoenix*, Miskohee, Okla.; WDAX, First National Bank, Centerville, Iowa; WDAY, Kenneth M. Hance, Fargo, N. D.; WDAZ, American Radio Relay League, Roy C. Ehrhardt, Traffic Assistant, Scranton, Pa.; KDZE, The Rhodes Co., Seattle, Wash.; KDZF, Automobile Club of Southern California, Los Angeles, Calif.; KDZG, Cyrus Peirce & Co., San Francisco, Calif.; KDZH, *Evening Herald*, Fresno, Calif.; WEAA, Fallain & Lathrop, Flint, Mich.; WEAB, Standard Radio Equipment Co., Fort Dodge, Iowa; WEAC, Baines Electric Service Co., Terre Haute, Ind.

Sixth. Code 2.—Detector tubes, type VT11, may be purchased for $5.50 each. Apply in person at the Army Sales Office, 58th Street, Brookiyn, N. Y. Three tubes only are allowed to a customer.

Seventh. English.—The filing of the application or the assignment of radio call letters does not constitute authority for operating a station. Paragraph 86 of the regulations governing radio communication, edition August 15, 1919, page 58, which authorized stations to be operated until the application for station license could be acted upon, was repealed on July 1st last. Owners of stations who fail to comply with the above requirements may expect action to be taken in accordance with the Act of August 13, 1912, section 1.

English.—Following publications may be obtained from Superintendent of Documents, Government Printing Office, Washington: Commercial Government and Special Radio Station Calls; price, 15 cents. Amateur Radio Station Calls; price, 15 cents. Radio Service Bulletin, published monthly, containing new commercial government and special stations, alterations and corrections, amendments to regulations governing radio communications; price, 5 cents per copy; annual subscription, 25 cents; and Radio Communication Laws, United States, 15 cents per copy.

English.—The National Electrical Code embodies regulations made by National Board Fire Underwriters to insure safety of building or other structures on which electrical installations of any kind have been made. Buildings in which electrical installations do not meet underwriters' requirements are ordinarily refused any insurance whatever or insurance is carried at a much higher premium. Those interested may obtain proposed revision of

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Pat. Pending
Make Your Phones Super-Phones
And as light as the radio waves you hear.
The soft rubber cushions exclude room noises.
The tone chamber conveys the sound to the sensitive part of the ear.
Can be installed in two minutes by anyone.
Sent prepaid in pairs on receipt of
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Mention make of your phones.
Special terms to dealers.
RADIO RUBBER SPECIALTY CO.
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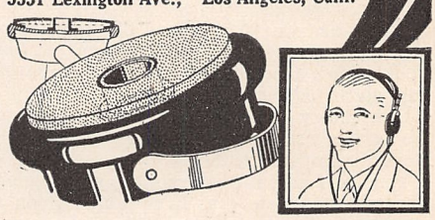

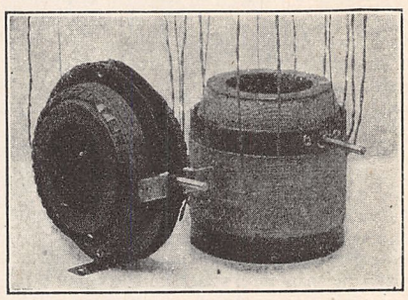

WJB
Variometers and Variocouplers
Variometer, $5.00 Coupler, $4.50
Write for Folder and Dealers' Prices
Warren J. Bauman Co.
LOCK HAVEN, PENNA.

A full page—
could not convey to you the advantages of why you should get in touch with us for your Radio Supplies. Our prices are positively far below anyone's on all Radio Apparatus.
SOLAR RADIO CORP.
532 NOSTRAND AVE.
879 FLATBUSH AVE.
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COLDMOUNT
OUR NEW CRYSTAL
No heat used to mount this crystal.
Dealers write for proposition.
RADIALL ELECTRIC CO.
187 Passaic St., PASSAIC, N. J.

rule 86, National Electrical Code of Radio Equipment, by sending a request to Bureau of Standards, Washington, D. C., for Circular 62.

English.—The Bureau of Standards, Washington, D. C., has designed a simple receiving set, cost of material of which does not exceed $10. This set will receive satisfactorily for short distances. Bureau of Standards, Circular 120, describes in detail construction and operation of this set. It may be obtained from Superintendent of Documents, Government Printing Office, Washington, D. C. Price, 5 cents.

Code.—Pamphlet entitled "Construction and Operation of Two Circuit Radio Receiving Set with Crystal Detector," recently published by the Bureau of Standards, may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C. Price, 5 cents.

Code.—All members of this Bureau should obtain copy of Radio Service Bulletin for May 1, 1922, which contains complete report of resolutions adopted by the recent Radio Telephony Conference, held in Washington. The provisions of this report will no doubt become laws at a later date, and for that reason are most interesting for amateurs.

Code.—Those contemplating use of a loop instead of ordinary aerial should make arrangements for rotating same in a complete circle of 360 degrees. The value of the loop aerial is in its directive effect. The Navy uses a loop aerial in its radio compass stations and the bearings of the ship from two or more of the stations fixes its position accurately.

English.—Following is list of new commercial land stations transmitting market and weather reports on 485 meters: WOI, Iowa State College, Ames, Iowa; WBAG, Diamond State Fibre Co., Bridgeport, Pa., WAAF, Union Stock Yards and Transit Company, Chicago, Ill.; WIZ, Cino Radio Manufacturing Co., Cincinnati, Ohio; KHD, C. F. Aldrich Marble and Granite Co., Colorado Springs, Colo.; WBAP, Wortham Carter Publishing Co., Fort Worth, Texas; KQP, Blue Diamond Electric Co., Hood River, Ore.; WTG, Kansas State Agricultural College, Manhattan, Kan.

Fourteenth. English.—Following is addition to list of radio stations, United States edition of June 30, 1921: 1XI, John Hayes Hammond, Jr., Gloucester, Mass.; 2XAJ, Delaware, Lackawanna & Western R.R. Co., Hoboken, N. J., car 782; 3XA, Howard R. Miller, Philadelphia, Pa.; 5XO, George McDouglas, Houston, Texas; 5YU, Tulane University, New Orleans, La.; 5ZAS, John C. Bell, Birmingham, Ala.; 5ZAU, Hubert E. Deben, Bay St. Louis, Miss.; 5ZAT, Lowrin G. Dill, Oklahoma City, Okla.; 6XL, General Petroleum Research Laboratory, Los Angeles, Calif.; 6ZW, Harold R. Shaw, San Francisco, Calif.; 7YN, Franklin High School, Portland, Ore.; 8XN, Bucknell University, Lewisburg, Pa.; 9YU, Doane College, Crete, Nebr.; 9YJ, Depauw University, Greencastle, Ind.

Fifteenth. English.—Code charts for deciphering amateur broadcasts transmitted in code are issued to all amateurs immediately upon becoming members of this bureau. Address applications for membership to Radio Amateur Bureau, Third Naval District, South and Whitehall Streets, New York City.

Sixteenth. Code 2.—A practical way to assemble the apparatus required for a regenerative receiver with audion detector and two-step amplifier at home—make a neat cabinet of three-quarter inch planed soft pine, outside dimensions three feet by one foot by nine inches with hinged cover three feet by one foot by nine inches. With copper wood screws, secure all apparatus conveniently and neatly to inside surface of cover and wire according to diagram. Members of the Radio Amateur Bureau may obtain list of apparatus and diagram upon request.

Seventeenth. English.—Following received from National Headquarters, Boy Scouts of America: "To all friends of the Boy Scouts of America: Ship ahoy! There has been developed recently a new kind of scouting which is planned especially for older boys between the ages of fourteen and eighteen. This is called the seascout branch of the Boy Scouts of America. It provides a wonderful opportunity for red-blooded boys to have lots of fun in learning the first lessons of the sailor's game. First comes swimming and lifesaving, then rowing in Navy cutters, sailing boats and learning how to navigate. Ask the nearest scout master to tell you more about it or write to National Headquarters."

Eighteenth. English.—Following received from Boy Scouts of America. (Same as the 17th.)

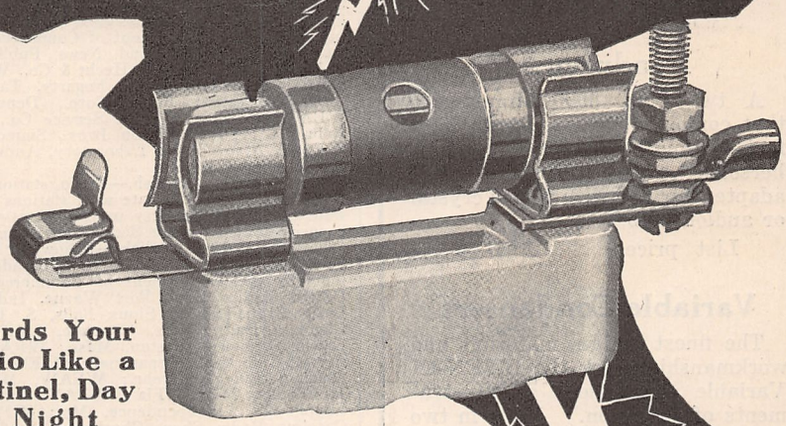
Nineteenth. Code 4.—Regenerative receiver may be used as a CW transmitter for short distances by inserting the key in series with the B battery.

Twentieth. Code 6.—Navy Radio supply salesman informed amateurs that automobile starting batteries of 6 volts could not be used for radio purposes. This is not true, as these batteries give excellent service when used for lighting receiving tube filaments.

Twenty-first. English.—Following additional call letters assigned broadcasting stations during week beginning June 5th by Department of Commerce: WEAX, T. J. M. Daly, Little Rock, Ark.; WEAY, Will Horwitz, Jr., Houston, Texas; WEAZ, Donald Redmond, Waterloo, Ia.; WFAA, A. H. Belo & Co., Dallas, Texas.; WFAB, Carl F. Weese, Syracuse, N. Y.; KDZW, Claude W. Gerdes, San Erancisco, Calif.; KDZX, Glad Tidings Tabernacle, San Francisco, Calif.; WFAC, Superior Radio Co., Superior, Wis.; WFAD, Watson Weldon Motor Supply Co., Salina, Kans.

Twenty-second. English.—Following partial list of additional call letters assigned broadcasting stations by Department of Commerce during week of June 5th: WFAF, Henry C. Spratley Co., Poughkeepsie, N. Y.; WFAG, Radio Engineering

BRACH
Vacuum
LIGHTNING ARRESTER



Guards Your Radio Like a Sentinel, Day and Night

Every lightning flash fills the air with static which has potential dangers to radio and home unless they are protected by the BRACH Vacuum Lightning Arrester. This unfailing sentinel requires no attention—it is on the job all the time, does not have to be switched and cannot become grounded. The action is like that of a safety valve in a steam system.

The Brach Arrester is made in two types. Type 200, for either indoors or outdoors if housed. Type 223, for outdoor service.

Both types are built up to a standard, not down to a price.

The Brach Arrester has been used successfully for 16 years on railway signal systems, the New York and other fire alarm systems and by the U. S. Army. Skilled engineers know its value and specify it.

Listed by the Underwriters' Laboratories

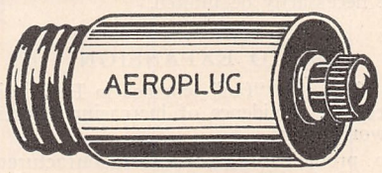
safe-radio

SOLD BY LEADING DEALERS EVERYWHERE

L. S. BRACH MFG. CO., NEWARK, N. J.

16 Years Specialists in Lightning Protective Apparatus

Also Makers of SOLDERALL—Mends Metal, Connects Wires.



AEROPLUG AERIAL

Aeroplug is simple, reliable, and the best you can get for an inside aerial.

Just screw in any lamp socket, and turn key on; it does not use any current.

Perfectly safe; you can't get a short circuit; nothing to get out of order; no danger from lightning, and very little static. Place your vacuum tube receiving set in any room you wish and use radiator, water pipe or gas pipe for ground. Satisfactory results obtained when used with crystal set within close proximity of large broadcast stations.

Price $1.50

If your dealer can't supply, we will mail direct

STAR MANUFACTURING CO. 868 BERGEN STREET NEWARK, N. J.

HAVE YOU SOMETHING TO SELL OR EXCHANGE?

A classified ad in Radio News will reach over 210,000 at a cost of only fifteen cents a word

Headphones

A two pole, 3000 ohm phone that combines clearness with comfort—strength without being cumbersome — and is equally well adapted for use with either crystal or audion bulb sets.

List price.....$7.50

Variable Condensers

The finest design, materials and workmanship mark the LISEN-IN Variable Condensers as "Instruments of Precision." Made in two sizes, listing at:

23 plate.....$2.50
43 plate..... 3.50

Roller Switches

To insure a perfect contact at all times without appreciable wear upon the contact points is an exclusive feature of the LISEN-IN Roller Switch. Price.....40c

All LISEN-IN products are guaranteed as represented and will give entire satisfaction or your money back without question.

At your dealer or jobber or direct from the manufacturer.

NATIONAL RADIO COMPANY

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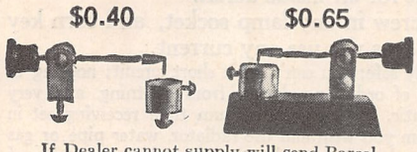
Live Wire Distributors
Write for Our Interesting Proposition

STA-JUST DETECTORS

Patented Ball Joint
All Metal Parts Nickel Plated

$0.40 **$0.65**



If Dealer cannot supply will send Parcel Post Prepaid upon receipt of Price

McCLOY ELECTRIC COMPANY
7131 KELLY STREET PITTSBURGH, PA.

THE BARKELEW ELECTRIC MFG. CO.
MIDDLETOWN, OHIO
RADIO GROUND SWITCHES, PORCELAIN PEDESTALS FOR SAME, "LEAD-IN" INSULATORS

Laboratory, Waterford, N. Y.; WFAH, Electric Supply Co., Port Arthur, Texas; WFAJ, HiGrade Wireless Instrument Co., Asheville, N. C.; WFAK, Domestic Electric Co., Brentwood, Mo.; KDZP, Newbery Electric Corp., Los Angeles, Calif.; KDZQ, Motor Generator Co., Denver, Colo.; WEAK, Julius B. Abercrombie, Des Moines, Ia.

Twenty-third. English.—Partial list of new call letters assigned broadcasting stations by Department of Commerce: WEAM, Borough of North Plainfield, North Plainfield, N. J.; KDZR, Bellingham Publishing Co., Bellingham, Wash.; KDZT, Seattle Radio Assn., Seattle, Wash.; WEAN, Shepart Co., Providence, R. I.; WEAO, Ohio State University, Columbus, Ohio.; WEAP, Mobile Radio Co., Mobile, Ala.; WEAQ, Y. M.C. A., Berlin, N. H.

Twenty-fourth. English.—Following is partial list of new call letters assigned to radio broadcasting stations by Department of Commerce: WEAR, Baltimore American and News Publishing Co., Baltimore, Md.; WEAS, Hecht & Co., Washington, D. C.; WEAT, John J. Fogarty, Tampa, Fla.; KDZU, Western Radio Corp., Denver, Colo.; WEAV, Sheridan Electric Service Co., Rushville, Nebr.; WEAU, Davidson Bros., Sioux City, Ia.; WEAW, Arrow Radio Laboratory, Anderson, Ind., changed from WMA.

Twenty-fifth. English.—Radio stations are not permitted to communicate with stations in another state or foreign country unless operating under a license granted by the Secretary of Commerce.

Twenty-sixth. English.—Following is list of new call letters assigned to radio broadcasting stations by the Department of Commerce: WFAS, United Radio Corp., Fort Wayne, Ind.; WFAT, Daily Argus-Leader, Sioux Falls, S. D.; KFAC, Glendale Daily Press, Glendale, Calif.; WFAU, Edwin C. Lewis, Boston, Mass.; WFAV, University of Nebraska, Department of Electrical Engineering, Lincoln, Nebr.; WFAW, Miami Daily Metropolis, Miami, Fla.; WFAY, Daniels Radio Supply Co., Independence, Mo.; WFAZ, South Carolina Radio Shop, Charleston, S. C.; WGAC, Orpheum Radio Stores, Brooklyn, N. Y.; WFAX, Arthur L. Kent, Binghamton, N. Y.

Twenty-seventh. English.—Same as 25th.

Twenty-eighth. Code 2.—Amateurs using loose coupled tuners for receiving can greatly decrease interference and atmospherics by using minimum amount of coupling consistent with required audibility.

Twenty-ninth. English.—In order to obtain the decoding chart, amateurs must first become registered members of this bureau. The decoding chart is used to decode and translate radio amateur broadcast which are transmitted in code.

Thirtieth. Code 2.—Navy radio, Sayville, call letters NDD. Send with arc set on 9,145 meters at 11 a. m., 3 p. m. and midnight.

N. A. H.

Radio News

(*Continued from page* 480)

the running costs would be considerable as compared with communication by land lines.

In view of the great development of the wireless telephone in the United States, particularly by amateurs, considerable publicity has been given to the subject in South Africa, particularly by the Marconi Company which is represented in Cape Town by the wireless agency. This company is manufacturing receiving sets from $25 to $200 in value. A radio society was recently formed in Cape Town composed of amateurs interested in wireless telegraphy and telephony (The Radio Society of South Africa, Argus Building, Cape Town), but in view of the sparseness of the white population, radio development in South Africa must necessarily be limited.

RADIO EXPANSION

A "fan" is a "fan" whether in Patagonia or Iceland. Evidence of increasing interest the world over.

No product of electrical manufacturers has ever taken the world so by storm as has the radio telephone receiving set, according to a statement made by the Electrical Division of the Department of Commerce. All over the globe broadcasting stations are daily disseminating news, music and commercial information to thousands of radio enthusiasts.

Outside of a few countries where existing political conditions have imposed restrictions, the use of radio is being taken up universally. The development has been most rapid in this country; in Europe, in South America, in Australasia, and to some extent

FROST FONES

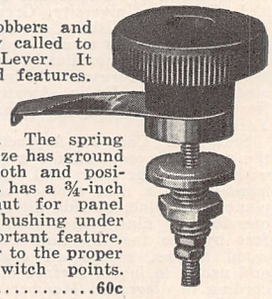
2000 Ohms **$5.00**

3000 Ohms **$6.00**

Highly Sensitive — Fine Tonal Qualities
Light and Comfortable
Easily Adjusted Head Band

DAVID KILLOCH CO.
Wholesale 57 Murray St., New York *Retail*

RTS
Switch Lever



The attention of jobbers and dealers is especially called to the RTS Bushing Lever. It has many improved features. The knob is of the well - known Marconi type, 1¾ inches in diameter. The spring lever of nickel bronze has ground ends, insuring smooth and positive adjustment. It has a ¾-inch bushing and locknut for panel assembly. A guide bushing under the knob is an important feature, as it raises the lever to the proper height for all switch points.
Retails at.....60c

AMATEURS

Amateurs will find RTS Specialties on sale at their regular dealers. But if he hasn't them in stock, we will supply you direct.

Discount to Dealers and Jobbers

Dealers and Jobbers: Write us today for special quotations and discounts on all RTS equipment.

RADIO TESTING STATION
DEPT. R-9 25 STURGIS ST.
BINGHAMTON, NEW YORK

Genuine* GANAERITE *Crystals

Individually Tone Tested.
Most Sensitive Mineral Rectifier Developed.
Mounted Crystals, Postpaid, 50c.
Trade Discounts to Dealers and Clubs.
Now Delivering Promptly on Large Orders.

THE HARRIS LABORATORY
26 Cortlandt Street New York City.

FOR 1c

DEALERS and FANS

We will keep you posted on anything new, valuable, and interesting in RADIO at no cost to you except a penny postal card with your name and address. We have nothing to sell you.

If dealer please state

L-S SERVICE, 22 Hudson Street, New York

ENGRAVING Radio Panels, Knobs, Buttons, Switch-Boards, Etc.

Clean-cut Machine Engraving Filled In With a Hard, Brilliant White Enamel.

CLARK ENGRAVING CO.
241 Virginia Avenue, Jersey City, N. J.

in Africa and Asia, broadcasting stations are being installed, with a resultant increasing demand for receiving sets.

In spite of an enormously increased manufacturing capacity, makers of radio equipment are still behind on their domestic orders, and this has naturally limited their interest in export trade. Nevertheless, the total value of wireless equipment shipped abroad during the first five months of this year is more than 60 per cent. of the total for the calendar year 1921, and the inquiries from abroad have increased considerably. As productive capacity here catches up with the domestic demand, a strong export trade may be expected.

Due to the volume and the variety of the home demand, American manufacturers have developed simple, compact, efficient, reliable, and economically priced receiving sets, which should take well abroad. As an indication of the interest shown by foreign buyers, one manufacturer reported a few days ago that as a result of circulars recently sent a list of London electrical importers, he had already received two inquiries by cable. As an interesting feature of the sales abroad, there has for several months been a considerable call for receiving sets from our neighbors on the north and south —Canada, Cuba, Mexico and Central America, where radio "fans" found that tube sets would permit them to readily listen in on some of the important American broadcasting service.

DAVIS TO BROADCAST LABOR NEWS

Not to be outdone in radio activities by the Agricultural, Post Office, Commerce and other civil departments, Secretary Davis has decided that it would be a good scheme to get the Labor Department on the Radio Map and tell the world what it is doing. To this end he has officially asked the Navy Department to aid in the broadcasting of activities relating to immigration quotas, labor arbitration, employment and child labor, as well as other official business.

FIFTY-SIX DAILIES BROADCASTING NEWS

The report of the recent meeting of the New York Associated Dailies at Kaaterskill that it was almost the unanimous sentiment "that radio has not as yet reached a point at which it is of advantage, and that most newspapers are going too far in devoting extensive space to it," is challenged by many radio fans and publishers.

What the basis of the opinion was, is hard for radio experts in Washington to see, as there are operating today 56 broadcasting stations owned by newspapers, three of which are in New York State.

No one can estimate the number of papers running radio departments correctly, but it is safe to say that practically two out of every three large dailies are doing so, and in some cities all papers carry considerable radio news, subscribing to several general and technical services.

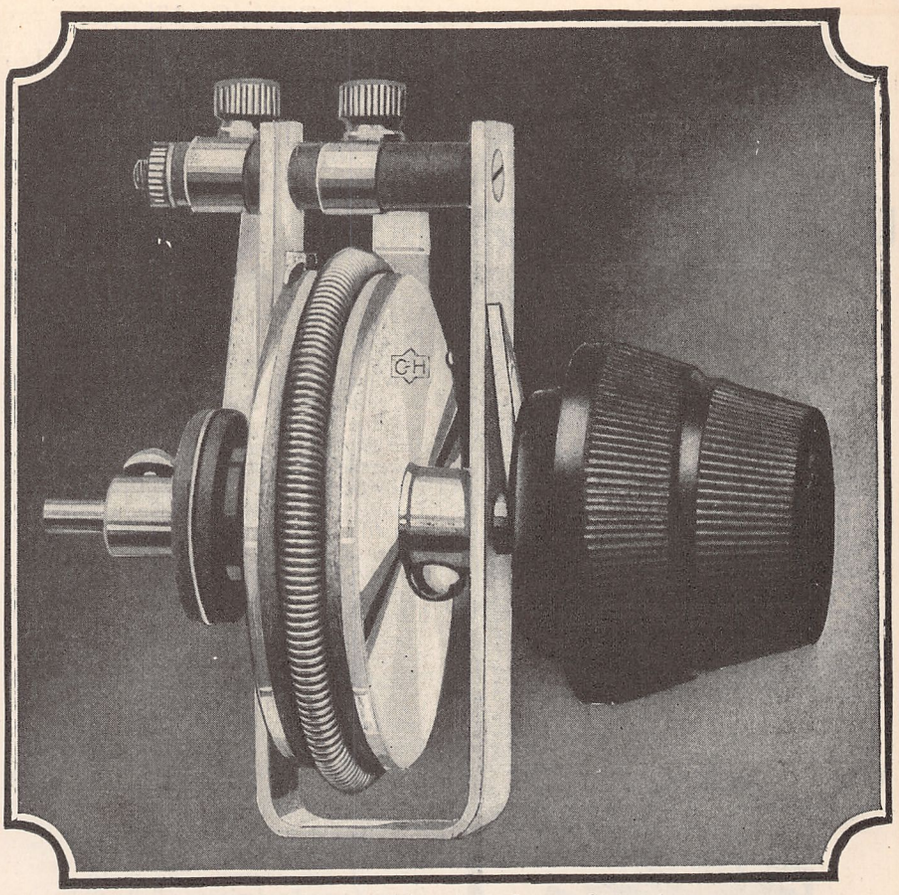
That it pays, is obvious by a glance at the advertisements, and an appreciation of the keenness of the competition in such cities as Detroit, Atlanta, Salt Lake and New Orleans, where practically all dailies vie with one another for both news space and broadcasting excellence.

To date none of the 56 broadcasting dailies has canceled its license and new papers are taking out licenses at the rate of about two each week.

In Washington all five daily papers use radio news services of one type or another, giving a column or more of space, and one is co-operating with a local broadcasting station.

A list of newspaper broadcasters follows:

Daily News Printing Co., Canton, Ohio.
Detroit *News*, Mich.
Examiner Print. Co., San Francisco.
Fort Worth *Record*, Tex.
Sacramento *Bee*, Calif.
New Orleans *Item*, La.
Los Angeles *Times*, Calif.
Seattle *Post Intelligencer*, Wash.



Type 11601-H1 *—With vernier for detector tube control.*

Built by Rheostat Builders

THE results obtained by the modern radio set with its delicately balanced circuits depend to a great degree upon the excellence of the control instruments.

The new C-H Vacuum Tube Rheostat embodies the experience of a quarter of a century in the art of building correct rheostatic control apparatus—it is the masterpiece of the specialist.

THE CUTLER-HAMMER MFG. CO.
MILWAUKEE, WISCONSIN

VACUUM TUBE RHEOSTATS

C-H Vacuum Tube Rheostats are made in two styles. Type 11601-H1 *has vernier attachment for fine regulation which is particularly necessary for detector tube control. Type* 11601-H2 *is without vernier and is designed for the control of the amplifying tubes.*

Both types are arranged for panel mounting, have positive travel stops, full "off" and full "on" positions, adjustable contact fingers, and are pointer indicating. Cone shaped knobs of genuine C-H *Thermoplax provide easy and non-leaking manipulation.*

Type 11601-H1 . . . $1.50
Type 11601-H2 . . . 1.00

At all radio dealers—or direct from factory at 10c *additional for carriage.*

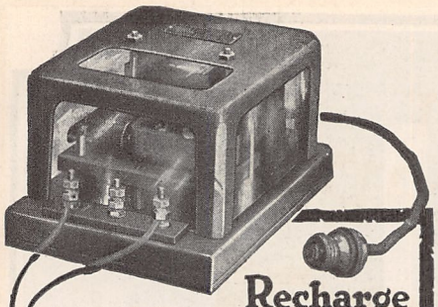
C-H VACUUM TUBE RHEOSTATS

RADIO DEALERS

We are Jobbers of Reliable Radio Apparatus and Parts, to Dealers, Schools, Colleges and Experimenters

CITY SUPPLY CO.

56 Warren St. (Telephone 6613 Barclay) New York



Recharge Your Battery at Home

Charges Both A and B Radio Batteries

Don't be without the use of your Radio Receiving Set while your battery is being charged. Get a Valley Charger and charge your battery right at home.

Attach the Charger to your home lamp socket—attach the clips to the battery terminals and you will get a quick, tapering charge which just exactly charges your battery, but cannot overcharge or harm it in any way.

Will charge the A 6 volt battery at a 6 ampere rate, and the B 22½ volt battery at the required ½ ampere rate. 45 volt B batteries may be connected in parallel so that they can also be charged.

SATISFACTION GUARANTEED. If your local distributor cannot supply you, write direct to

VALLEY ELECTRIC COMPANY,
Department R, ST. LOUIS, MO.

- - - - - - - Mail the Coupon - - - - - - -

Valley Electric Co., Dept. R, St. Louis, Mo.
Gentlemen: I am enclosing money order (or check) for $18.00, for which send me a Valley Battery Charger with five-panel glass display case and indicator. If not satisfactory, I will return it and get my money.

Name

Address

$18.00
F.O.B. St. Louis

VULCANO
RADIO TORCH

Self-Heating Soldering Iron, blow torch combination.

Postpaid for
$2.50

Latest Device
BIG HIT

with electricians and mechanics. Points on Radio soldering FREE. Certificate of honorable mention from Radio Inst. of the N. Y. Evening Mail.

AGENTS WANTED

NATIONAL RADIO SALES CO.
32r UNION SQ., N. Y. C.

VOLTA PRODUCTS ARE of Exceptional Perfection

Crystal Sets ..... $7.50 List
Variometer, Special ..... 2.75 List
Variocoupler, Improved Sharp Primary Adjustment ..... 3.25 List

VOLTA ENGINEERING CO.
172-4 Lorimer Street Brooklyn, N. Y.

VULCANIZED FIBRE

Be sure and specify "WILMINGTON FIBRE"

Sheets, Rods, Tubes, Washers, Etc., Specialties

Wilmington Fibre Specialty Co., Wilmington, Del.
Branch Offices "Everywhere"

Minnesota Tribune Co., Minneapolis.
Oregonian Publishing Co., Portland.
Palladium Printing Co., Richmond, Ind.
Post Despatch, St. Louis, Mo.
Register & Tribune, Des Moines, Ia.
Ridgewood *Times*, N. Y.
Rochester *Times Union*, N. Y.
Atlanta *Journal*, Ga.
Atlanta *Constitution*, Ga.
Herald Pub. Co., Modesto, Calif.
Los Angeles *Examiner*, Calif.
Modesto *Evening News*, Calif.
Spokane *Chronicle*, Wash.
Times Picayune, New Orleans, La.
The *Deseret News*, Salt Lake City, Utah.
Republican Pub. Co., Hamilton, Ohio.
Detroit *Free Press*, Mich.
Newburgh News Print. & Pub. Co., N. Y.
Times Despatch Pub. Co., Richmond, Va.
Tribune Pub. Co , Oakland, Calif.
The *Star Telegram*, Fort Worth, Tex.
Bakersfield *Californian*, Calif.
Daily States Pub. Co., New Orleans, La.
Pasadena Star News Pub. Co., Calif.
Herald Pub. Co., Klamath Falls, Wash.
Kansas City *Star*, Mo.
Quincy *Whig Journal*, Ill.
Quincy *Herald*, Ill.
Tampa *Daily Times*, Fla.
The Tribune, Inc., Great Falls, Mont.
Arizona *Daily Star*, Tucson, Ariz.
Florida *Times Union*, Jacksonville.
Hartford *Courant*, Conn.
Muskogee *Daily Phœnix*, Okla.
Telegram Pub. Co., Salt Lake City, Utah.
Fresno *Evening Herald*, Calif.
Bellingham Pub. Co., Wash.
Star Bulletin, Honolulu, T. H.
Baltimore *American & News*, Md.
Dallas *Morning News*, Tex.
Daily Drovers Journal, Chicago, Ill.
Daily Argus-Leader, Sioux Falls, S. D.
Houston *Chronicle*, Tex.
St. Cloud *Times*, Minn.
Glendale *Daily News*, Calif.
Miami *Daily Metropolis*, Fla.
Southern American, Ft. Smith, Ark.
South Bend *Tribune*, Ind.

STRAIGHTENING OUT A STRAIT

Three new radio compass stations in Michigan have just been completed by the Navy Department. They are at Grand Marais, Whitefish Point and Point Detour, where they will serve the ships that pass back and forth through Sault Ste. Marie from Lake Superior to Lake Huron—a dangerous passage and one marked by the remains of many wrecks, caused chiefly by fogs.

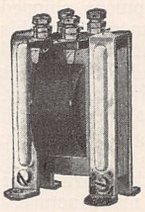
With the three compass stations in operation it should now be a simple matter for all mariners to secure frequent and exact compass bearings, and avoid adding to the "graveyard" of the Lakes.

A naval subchaser, on a recent cruise into Lake Superior, made a test run for the calibration of the stations at Grand Marais and Whitefish Point which work together off the northwestern entrance of the strait, and has reported the job completed and the stations ready for work as soon as the personnel is assembled.

Naval radio stations guard all the ships on the Great Lakes and it is virtually impossible for mariners equipped with wireless to get lost in the Lakes today. The completion of the three stations finishes a chain of 15 naval shore stations from Duluth to Buffalo. A ship can now keep in constant touch with its home port, provided its headquarters is fitted with radio. Both owners and operators, it is said, are rapidly coming to install radio on their ships, several companies having their entire fleets and home stations so equipped, many of them through the purchase of surplus naval radio equipment.

The use of the naval radio stations at Alpena, Buffalo, Chicago, Cleveland, Detroit, Duluth, Eagle Harbor, Great Lakes, Mackinac Island, Manistique, Milwaukee and Whitefish Point, for relay purposes, saves delayed and expensive communication when contact with the owner or operating office is necessary. Very soon every ship on the

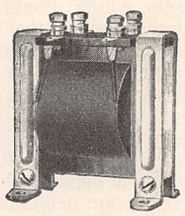
JEFFERSON
Amplifying Transformers



No. 45

BY ACTUAL TEST JEFFERSON Amplifying Transformers have proven superior to anything now on the market. Try them and note the improvement, the absence of distortion and the clearness of tone.

FURNISHED IN TWO TYPES, either mounted or unmounted. Wound with No. 40 and No. 44 wire on a core of highest grade 36 gauge Silicon steel.



Send for Radio Bulletin No. 41

REASONABLY PROMPT DELIVERIES

JEFFERSON ELECTRIC MFG. COMPANY
424 S. Green St., CHICAGO

Radio Supplies

Clapp-Eastham, Paragon, Westinghouse RECEIVING SETS

Western Electric, Baldwin, Murdock and Brandes PHONES

Cunningham Tubes

Magnavox Loud Speakers

Remler Products

Radio Corporation Apparatus

22½ Volt Tapped B. Battery, $2.75

ELECTRIC SUPPLY CO.
Everything in Radio
PORT ARTHUR, TEXAS

!! DEALERS !!
—Liberal Discounts—
PHONE PLUGS, LIST, $1.00
Rheostats—3" and 4" Dials, Fixed and Variable Condensers, Binding Posts, Copper Lugs, Contact Points, etc.
NEW YORK RADIOPHONE CO.
32 UNION SQ.--NEW YORK CITY

ELWOOD HEAD SETS
ARE GOOD HEAD SETS
ELWOOD ELECTRIC COMPANY
2-4 Randall Ave., Bridgeport, Conn.

STEINER ELECTRIC CO.
115 N. Wells St., Chicago
RADIO SUPPLIES
Branch Store—5239 N. Clark St.
Wholesale and Retail

Lakes will be equipped with radio just as all trans-Atlantic steamers are equipped, for safety and convenience Government officers believe.

GREAT LAKES STATION BROADCASTS

The naval radio station at Great Lakes began broadcasting news and weather and crop bulletins for the Department of Agriculture on June 16, handling about 3,200 words daily with a 30-k.w. arc on a wavelength of 4,900 meters.

Radio News Laboratories

(*Continued from page* 444)

Company. On the contrary, they are absolutely independent and have been called in from the outside in order to give the RADIO NEWS LABORATORIES the independence that is needed for its success.

Short biographies of Messrs. Pacent and Clement follows:

LOUIS GERARD PACENT

Few men have enjoyed as diversified an experience in the wireless world as Louis Gerard Pacent. Although a comparatively young man, Mr. Pacent has run the entire gamut of radio activities, including student, amateur, technician, inventor, instructor, author and manufacturer, and his varied experience has resulted in his being recognized by many as one of the best posted, all-around radio men in the field.

Mr. Pacent is president of the Pacent Electric Company, engaged in the production and distribution of his own inventions on a national basis. He is an executive member of the Associated Manufacturers of Electrical Supplies and chairman of one of its most active committees; Member of the Institute of Radio Engineers; Member of the American Institute of Electrical Engineers and director and chairman of the Committee on Papers and past Vice-President of the Radio Club of America.

During the war Mr. Pacent divided his activities between the radio department of the U. S. Army and Navy and succeeded in designing and putting into service several instruments which helped win the war.

Among Mr. Pacent's numerous inventions are: Pacent Universal Plug, Pacent Twin Adapter, Pacent Multi-jack, Mesco Radio Buzzer, several sending keys, Duplex inductance mounting, several inductance attachments and several receiving and transmitting sets. His writings include: "Manual of Wireless Telegraphy," "How to make a Trans-Atlantic Wireless Receiving Set," a number of papers and articles, some of which are as follows: "The Wavemeter in Wireless Telegraphy and Telephony," "A Radio System for Simultaneous Sending and Receiving," "The Relay Antenna Transfer Switch," "Radio Telephony," published in RADIO NEWS, etc., etc.

Being a student of wave lengths, Mr. Pacent predicted in 1912 that the Atlantic Ocean would be spanned with one kilowatt at 200 meters, much to the amusement of several prominent radio engineers. Several months ago the Atlantic was spanned by radio with less than 1 K. W. on 200 meters. Recently Mr. Pacent predicted in a statement in the press that radio broadcasting would be done on as low as 10 meters in the future and then 25 to 50 stations could operate simultaneously within a small area without interference because of the extreme high frequencies at short wave lengths. It remains to be seen if Mr. Pacent's prediction will materialize.

As this brief biography is being written the Century Company of New York is publishing "The Complete Radio Book" of which the authors are Raymond Francis Yates and Mr. Pacent.

LEWIS MASON CLEMENT

Radio Engineer Born. Oakland, Calif., Jan. 25, 1892. B. S. in E. E. University of Calif., 1914.

Testing mechanical properties of wires and cables. Pacific Steel & Wire Co., 1908. Radio Operator S. S. Spokane, S. S. Norwood, construction department of the United States Wireless Tel. Co., 1911.

Radio Operator S. S. Senator, construction department of the United and Marconi Wireless Tel. Co., 1912. Instructor at the A. Van du Vaillen School of Engineering, 1913-14.

Shift Engineer and Assistant Engineer in charge at the high-power stations at Kahuku, Hawaii, and Bolinas, Calif. Marconi Co. 1914-1916.

Since May, 1916, Research Department of the Western Electric Co. Engaged in electrical design and development of radio equipment used by the Signal Corps and Navy Department during the war for aircraft, submarine chasers, etc. In charge of the electrical design of the Model T. B. duplex radio telephone sets used by the U. S. Navy. Electrical design and development of radio equipment for China. Design and installation of the Avalon-Los Angeles Radio Toll Circuit.

It is Safer and Cheaper to buy the Best

KENNEDY

Radio • Receiving • Equipment

has been the leader so long that it is recognized today as the standard by which all radio receiving equipment is judged. To meet the present demand for Kennedy Regenerative Receivers, we have just opened a

New Factory at Saint Louis

from which to supply the market east of Rocky Mountains.

In buying Radio Equipment remember it is always safer and cheaper to buy the best.

WRITE FOR LATEST BULLETIN C-3

Address Our Nearest Office

All Kennedy Radio Equipment is illustrated and fully described in this pamphlet, which supersedes all others.

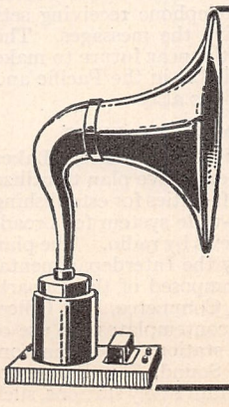
KENNEDY EQUIPMENT

Kennedy Regenerative Receivers are licensed under Armstrong U. S. Patent No. 1,113,149 and are sold by good dealers everywhere

THE COLIN B. KENNEDY COMPANY

INCORPORATED

SAN FRANCISCO U. S. A. SAINT LOUIS



Vitalitone LOUD SPEAKERS

ON THE MARKET THREE YEARS

NEW MODEL, $40

MOST BEAUTIFUL APPEARANCE, HIGHEST EFFICIENCY, SENSITIVE, NO DISTORTION

FULLY GUARANTEED, WITHOUT RESERVE

Immediate Delivery

MANUFACTURED BY

VITALIS HIMMER

205 SIXTH AVE. NEW YORK

"SHRAMCO PRODUCTS"

Amateurs: Send 5c in stamps, today, for our new Catalogue L showing complete line of parts, raw materials and high grade apparatus.

Dealers: Write for our attractive proposition.

THE SHOTTON RADIO MFG. COMPANY, Inc.

8 Market St. Albany, N. Y.

FINCH RADIO RELAY

(PATENTED AND PATENTS PENDING)

PERMITS YOU TO—

1 AUTOMATICALLY Receive and Record Radio.
2. OPERATE a Telegraph Sounder by Radio.
3. RING a Bell by Radio.
4. IGNITE Explosives by Radio.
5. CONTROL a Moving Vehicle by Radio.
6. OPERATE a Burglar Alarm by Radio.
7. SIMULTANEOUSLY Record and Retransmit Radio Messages.

Literature Sent Upon Receipt of Stamp

FINCH RADIO MFG. CO.

303 FIFTH AVENUE, NEW YORK CITY

Hard to Get Wireless Supplies

E-Z to Get by Mail

Phones - Parts - Panels

We will ship by return mail and pay postage ourselves. Send money order or certified check. No stamps.

Reference: Merchants and Manufacturers Bank, Newark

Murdock No. 56	2000 ohm	phones	$5.00
Murdock No. 56	3000 "	"	6.00
Federal No. 53W	2200 "	"	8 00
Holtzer Cabot	2200 "	"	8.00
7-strand cable construction copper aerial wire, per 100-ft. coil			.65

See last month's Radio News for our Panel advertisement. What radio parts do you need for your set? Send enquiry for price and delivery. We have a large stock of the parts you know.

L. FUNKE & CO.

223 Washington St., NEWARK, N. J.

Author "Vacuum Tube Circuits," Everyday Engineering Magazine. "The Avalon-Los Angeles Radio Toll Circuit," with J. M. Ryan and D. K. Martin. (Institue. of Radio Engineers).
Member I. R. E.
Member R. C. A.

CHICAGO TO RIVAL VENICE DURING COMING PAGEANT

City Buys Apparatus to Throw Music Over the Waters of Lake Michigan

The City of Chicago expects to spread broadcast the oratorical and musical features that will mark the Pageant of Progress to be celebrated in the Illinois metropolis, July 29th to August 14th. To assure perfect acoustic accommodations for the thousands who will gather in and about the Municipal Pier during the festivities, George E. Carlson, Commissioner of Electricity, has purchased the greatest public address system ever sold by the Western Electric Company, the same concern that first brought this modern method of voice amplification before the world during the Victory Way ceremonies after the Armistice and later at President Harding's inauguration, and at the burial of the Unknown Soldier at Arlington.

A remarkable degree of amplification will be possible with the apparatus. Although the Chicago Municipal Pier, the scene of the exposition, covers an area of 3,000 by 300 feet, the engineers expect little trouble in carrying the vocal entertainment to the most distant corner of the structure. They even promise to feature the nights by hurling the speeches and music out over the waters of Lake Michigan, affording the boating parties planned during the celebration an experience that will probably appeal to them as a gigantic reproduction of the famous serenades of Venice. In recent demonstrations the transmission experts of the Western Electric and American Telephone and Telegraph Companies have proven their ability to magnify sound billions of times and make it heard without the aid of any receiving apparatus five miles from the speaker.

During the intervals in the regular pageant program it has been arranged to connect the public address system with a radio telephone receiving set capable of picking up messages from most of the Mid-West transmitting stations.

—*Abstracted from Western Electric News.*

NATION-WIDE AGRICULTURAL RADIO SERVICE ESTABLISHED

Government weather, crop, and market reports are to be broadcast daily from the Arlington and Great Lakes wireless stations of the Navy Department, the United States Department of Agriculture announced to-day.

This makes possible the receipt of agricultural reports by radio throughout virtually the entire United States, and is the most important step yet made in broadcasting agricultural information, according to W. A. Wheeler, in charge of the radio work for the department. The new service began about June 15th.

Continuous wave radio telegraphy will be used to broadcast the reports, but it is expected that there will be considerable rebroadcasting by radio telephone so that any one in the Eastern two-thirds of the United States having radio-telephone receiving sets may be able to receive the messages. The department hopes in the near future to make the market news available in the Pacific and Rocky Mountain regions also.

USE GOVERNMENT STATIONS

The use of the Arlington and Great Lakes stations is part of an extensive plan to utilize existing Government facilities for establishing a dependable, nation-wide system for broadcasting agricultural news by radio. The plan has been approved by the Interdepartmental Radio Committee, composed of the Departments of Agriculture, Commerce, Post Office, War and Navy, and contemplates the use of high-powered Navy stations at Arlington, Great Lakes, Puget Sound, San Francisco, and New Orleans; certain Army stations, such

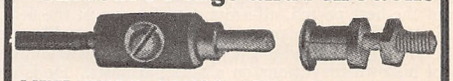
"ATTENTION AMATEURS"

Stromberg-Carlson Phones	$7.50
Thordarson Amp. Transformer	4.50
Paragon Sockets	1.00
Radiotron No. 201	6.50

QUAKER LIGHT SUPPLY CO.

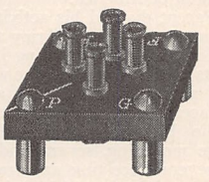
728 Arch Street
Philadelphia, Pa.

Miniature Plugs and Pin Jacks



MINIATURE PLUGS ARE used for battery control or any switching purpose. More efficient, quicker in action and neater in appearance than binding posts. Supplied with side binding screw. Used with pin jacks, in nickel or brass finish.

Plugs—Cat. No C-1 Price 25c
Jacks—Cat. No. C-100-200 Price 11c



A. V. T. SOCKET with many distinct advantages. *Greater contact surface, giving better connections that will not work loose. Pins mounted on genuine polished bakelite base, fused to prevent burning out tube.*

Write for Descriptive Literature and Price Lists

Ozburn Abston Radio Company, Inc.

Formerly V. H. LAUGHTER

600-612 Monroe Ave. MEMPHIS, TENN.

Booth Tarkington's Famous $1000 Prize Story For Only 15 Cents

You will wonder how even so brilliant a writer as Booth Tarkington could put the joy, the pathos, the tears, the emotion, or develop the startling situations, the surprising truths, the romance, the scintillating repartee, the exciting scenes that made hundreds of thousands of people pay $2 a copy for his famous $1000 Pulitzer prize story, "ALICE ADAMS." The Pathfinder, America's fastest growing illustrated news and story weekly for the whole family, will publish this wonderful story of present day American life complete in 13 issues, beginning Sept. 23. The Pathfinder gives each week an unequaled digest of the world's doings, including affairs at Washington. It is chuck full of just the kind of reading you want. Best serial and short stories you can find anywhere. Stunts, tricks, and amusements for the children. You can get this splendid paper on trial 13 weeks, including the "Alice Adams" story complete, for 15 cts. in coin or stamps. You can also order for your friends at 15 cts. each; but send at once so as not to miss the start of the story.

The Pathfinder, 444 Langdon Sta., Washington, D. C.

JAXON "B" Storage Battery CHARGER

For use on AC Current, will fully charge "B" Battery for a few cents in about ten hours. Simple to operate, highly efficient.

Price, each, without Mason jar.....75c

Write for prices on "A" Storage Batteries

JACKSON BATTERY COMPANY

1124R JACKSON BLVD. CHICAGO, ILLINOIS

OFFICIAL

RADIO BROADCAST MAP

(In Two Colors) 10 Cents Postpaid

Experimenter Pub. Co. 53 Park Place, New York

as those now located at Fort Bliss and Fort Sam Houston, Tex., and the present post-office stations which have been broadcasting agricultural reports for more than a year at Washington; Omaha and North Platte, Neb.; Rock Springs, Wyo.; and Elko and Reno, Nevada.

It is said that under favorable static conditions both the Arlington and Great Lakes stations can be heard over the entire country, but that under average conditions the range is about two-thirds the eastern part of the United States. The reports will be received by State departments of agriculture and agricultural colleges for rebroadcasting by radio telephone; local and private stations licensed to broadcast agricultural reports; county agents, shipping associations, and other farm organizations; and local amateurs who make a business of copying for local individuals and agencies the agricultural reports broadcasted by radio telegraph.

SCHEDULE IS COMPLETED

Extension of the service to all the high-powered stations mentioned is restricted at the present time only because the leased telegraph wire system of the Department of Agriculture over which the reports are dispatched for broadcasting does not reach some of those points. However, in the late summer or autumn when atmospheric conditions are more favorable for radio work, a move may be made to extend the service by relaying messages to the various stations.

The tentative schedule of reports to be broadcasted from the Arlington and Great Lakes stations follows. After a two-weeks' trial a fixed schedule will be established.

From the Great Lakes station a report of live stock receipts at five markets will be dispatched at 8 A. M. At 9 A. M. the weather reports which the Arlington and Great Lakes stations have been sending out for some time will be released. A brief report of the hog markets will be flashed at 9:15 A. M. A report of fruit and vegetable shipments and f. o. b. prices will go out at 10 A. M., followed by a New York and Chicago dairy report at 10:40 A. M. From 11 A. M. to 1:05 P. M. complete live-stock reports of the Chicago, Kansas City, St. Louis, St. Paul and Omaha markets will be sent out. A report of the grain markets will go out at 1:45 P. M.; a report of the fruit and vegetable markets at 2:30 P. M.; hay and feed market reports at 3:45 P. M.; a special weather report at 4 P. M.; dairy and poultry reports at 5 P. M.; a summary of all markets at 6 P. M., and a weather report at 8:50 P. M. Arrangements are also being made to dispatch crop information. The program for Arlington is similar, but will include more detailed information regarding fruits and vegetables.

PROGRESS HAS BEEN RAPID

In less than two years the Department of Agriculture has established practically a nation-wide service for broadcasting weather, crop, and market reports by radio telegraph and radio telephone. The department early recognized the value of radio as a rapid-fire method of getting agricultural news to farmers and others interested in food production and marketing and every opportunity of utilizing the new science was seized.

The use of radio in broadcasting agricultural reports is having a far-reaching effect in extending knowledge of market conditions, and will inevitably contribute much toward a better system of marketing farm products, in the opinion of Mr. Wheeler.

NAVY PLANS AIRSHIP AND RADIO STATION—NEW LOW AERIAL LEAVES FIELD CLEAR

THE two largest airships in the world, now building for the Navy, one at Lakehurst, N. J., and one in Friederichshafen, Germany, will have the latest and best radio equipment capable of development. Anticipating their completion, their home port is being fitted up for their arrival with a high-powered radio station.

DICTOGRAPH HEAD SET

Why the Price Is $12.00

If anybody could make a Radio Head Set as good as the Dictograph Radio Head Set to sell at a lower price, the Dictograph Products Corporation could do it. No other organization has its facilities for the manufacture of sound-reproducing apparatus. For twenty years it has specialized in this field; it is the largest manufacturer of "watch case" receivers in the world. The world-famous name Dictograph is your guarantee—it stands for the same perfection, sensitiveness and accuracy found in all Dictograph Products; the Dictograph System of Telephones, the Detective Dictograph, the Acousticon for the Deaf. See the Dictograph Head Set at any dependable radio dealer's—try it; and be sure to look for the name Dictograph.

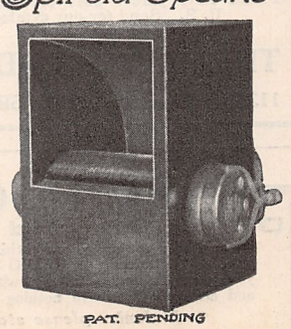
DICTOGRAPH PRODUCTS CORPORATION
Executive Offices
220 West 42d Street - - - - New York City

3000 Ohms

Price $12.00

Spirola TRADE MARK

Most beautiful "Spirola Speaks" **LOUD SPEAKER** made, cabinet type, fine proportions and finish. A real ornament for the home—*horn type speakers will soon be classed with "tin horn" phonographs.* Only 8 in. high, yet the 23-in. **SPIRAL** sound chamber gives **SPIROLA** the rich tone of the finest phonographs. Uses both phones of your headset—unsurpassed for loudness. See this high grade article at your dealers—or we'll send you one postpaid.

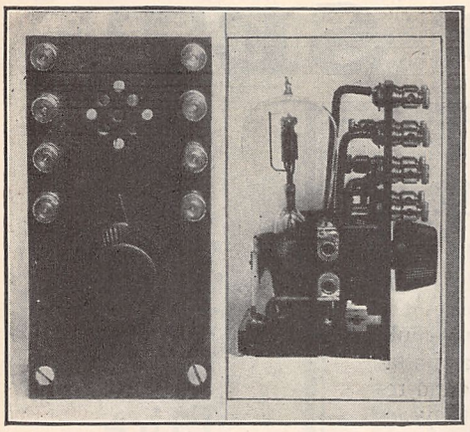


$3.85

L. H. DONNELL MFG. CO. Box 70 Ann Arbor, Mich.

KRL

High Grade V. T. Control Units



SPECIFICATIONS

PANEL: Bakelite Grade XX 4⅝x2⅜x⅜ inches. Most compact on the market.
BINDING POSTS: Polished nickel plated with holes for cord tips.
BASE: Bakelite ⅜ inch into which is moulded tube receptacle. Contact springs of nickel plated phosphor bronze.
RHEOSTAT: High grade No. 120A Fada type.
GRID CONDENSER: Standard Dubilier Type 601 mica (not paper) .0005 M.F. with adjustable grid leak.
PHONE CONDENSER: Standard Dubilier Type 601 mica (not paper) .001 M.F. wired across phones and B batteries, a distinctive feature.
WIRING: Heavy buss bar of No. 12 tinned copper protected by spaghetti tubing. Compact design insures lowest possible resistance in connections.
OPERATION: Signal strength guaranteed not to be excelled by any similar instrument.
Price each, $5.75. Postpaid and insured. Radio frequency units of similar design with Murad transformer mounted on bakelite base in rear, $12.00. Audio frequency unit with Federal transformer, $13.00. With Thordarson transformer, $10.00. Units may be harmoniously connected.
Subject to return in five days after receipt if not satisfied. At your dealers or direct from

The Kehler Radio Laboratories
Dept. R **ABILENE, KANSAS**

SPECIAL DISCOUNT 10%

Cardboard Tubes, Seamless, Gray, ⅛-inch wall, 2½x12, 25c; 3x12, 30c; 3½x12, 35c; 4x12, 40c; 4½x12, 45c; 5x12, 50c; 5½x12, 55c; 6x12, 60c.

Contact Points, Nickeled.....6 for 30c
Contact Points, Brass.....6 for 25c
Stops, Nickeled.....2 for 10c
Phone Binding Posts, Nickeled, each.....15c
Binding Posts, H.R. Top, Nickeled, each.....10c

ROUND BRASS RODS, POLISHED

THREADED		
1/16x13....15c	1/16x18....20c	1/16x22....25c

SQ. BRASS RODS, POLISHED AND DRILLED

		BRASS
1/16x 7....15c	1/4x 7....20c	SLIDERS
1/16x 9....15c	1/4x 9....20c	3/16....25c
1/16x13....20c	1/4x13....25c	1/4....30c

MAGNET WIRE

Price per ½ lb. ¼ lb. ½ lb. ¼ lb. ½ lb. ¼ lb.

B.&S. Ga.	Enameled		Double Cotton		Double Silk	
No. 18	—	—	$.75	—	—	—
No. 20	$.60	$.30	.80	$.40	$1.00	$.50
No. 22	.65	.35	.85	.45	1.05	.55
No. 23	—	—	—	—	1.10	.60
No. 24	.70	.40	.90	.50	1.10	.60
No. 26	.75	.45	.95	.55	1.15	.65
No. 28	.80	.50	1.00	.60	1.20	.70
No. 30	.85	.55	1.05	.65	1.25	.75
No. 32		.60				

Prices net; parcel post prepaid anywhere in U. S. Send for our catalog FREE.

THE KING RADIO CO.
113 Sheridan Ave., PITTSBURGH, PA.

FOR 1c

DEALERS and FANS

We will keep you posted on anything new, valuable, and interesting in RADIO at no cost to you except a penny postal card with your name and address. We have nothing to sell you.

If dealer please state

L-S SERVICE, 22 Hudson Street, New York

A new type of radio transmitting antenna without towers has just been installed at the Naval airship base at Lakehurst, N. J., Naval Radio Station NEL. In an effort to keep the big landing field clear for the two giant rigids ZR-1 and ZR-3, and to eliminate high towers and aerials, the radio engineers of the Navy designed a long, low aerial. It is nearly 800′ long and fully 120′ wide, forming a sort of gridiron, mounted on poles only 60′ in height instead of between 150′ and 200.′ Technically, it is a multiple-tuned antenna with several ground leads. By erecting the aerial along one side of the field a clear open space is left for maneuvering the ships.

Recent transmission tests with the new aerial have carried messages on 900 meters to Newport, R. I., and Norfolk, Va., distances approximating 200 and 250 miles, which indicates excellent daytime service. Daytime communication with the big airships when they are cruising within about 300 miles of the station is promised. At present, a vacuum transmitting set with 1 K.W. in the antenna is used, and the experts believe that on clear nights in winter communication can be carried on with aircraft or ships fully 2,000 miles out on the Atlantic. This will insure the picking up on the German-built ZR-3, on her maiden trip to her home port, before she is a third of the way over. When the R-38 made her initial trans-Atlantic cruise, she was not heard from until within about 600 miles of New York.

The new aerial was designed and built by the Naval Aircraft Radio Laboratory at Anacostia, and installed at Lakehurst by radio men from the Philadelphia Navy Yard.

In addition to the new radio transmitting set, Lakehurst will have a radio compass station which will enable the dirigibles to determine their positions in the air within a radius of 200 miles, and locate the field when returning from a cruise in darkness or in dense fogs. Radio equipment for the big rigid ships has not yet been designed, but it is understood that as plenty of room will be available for engine-driven generators producing great transmitting power, a very long range set can be installed, and it is hoped that both radio telegraph and telephone communication can be carried on up to 300 and 100 miles, respectively.

ARMY AIRSHIP SETS

Army plans for new radio sets for their semi-rigid airships call for central power stations which would include generators geared to gasoline engines, after the fashion in which a magneto is driven, but never before attempted. The French tried out belt-driven electrical generators, but with little success. However, representatives of the Air Service Engineering Department at McCook Field expect to develop a central power plant that will give sufficient power for putting ½ K.W. in the antenna and also power for lighting, heat and electrical control work.

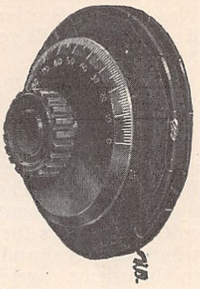
The Army Air Service plans to use the new Signal Corps set 135, combining radiophone and telegraph circuits good for distances up to 75 miles and 200 miles, respectively. The range will be greater than is planned for the big Martin Bombers, however, as better facilities for erecting aerials are available on airships than on planes. One method considered is to install the antenna within the envelope; another is to suspend it below the ship, drawing it up upon landing; while a third contemplates hanging the wires of the aerial along the sides and over the top of the ship. Experiments will determine which of these methods is the most efficient.

Naval radio experts are loath to reveal their definite plans for the radio equipment of the ZR ships, but it is said that they may parallel the Army's ideas, although their ships will be about twice the size of the largest Army semi-rigids now planned, giving them more latitude and more room for equipment.

A New Type Variometer

Rogers Receiving Radiometer

Smaller—Simpler—Less Costly—Better



Tuning efficiency and sharpness is greatly improved because the dielectric material is reduced to the absolute minimum—no wood, paraffine, shellac or varnish is used.

Takes up but a small fraction of the space required for ordinary variometers.

Only one supporting bushing is used for the entire assembly; this bushing is also used for the electrical contact between the two inductors.

For long distance, short wave sets, two Rogers Receiving Radiometers will give as good, if not better, results than any other type of installation. Can be used in any part of the circuit in which the ordinary ball type variometer can be used.

Price $4.00 each
without dial and knob

If your dealer cannot supply you, send his name and money order or check for the number of Radiometers you want, and we will see that they are delivered to you at once.

LUDWIG HOMMEL & CO
530-534 FERNANDO ST. PITTSBURGH, PENNA

IMMEDIATE DELIVERIES TO CONSUMERS

Dreyfuss 'Phones

(CONCERT TYPE)

PRICE $8.00

Complete Crystal Receiving Sets

1 pair Dreyfuss 'phones
100 feet aerial wire
2 insulators 1 ground clamp

PRICE, $14.00

P. M. DREYFUSS
FOURTH FLOOR
150 CHAMBERS ST., N. Y. C.

Wireless Operators Wanted

LEARN WIRELESS AT HOME IN SPARE TIME

The demand for experts exceeds supply. Pays big salaries, $125 to $250 a month to $10,000 a year. Our home course will make you an expert operator in shortest possible time. Instruction by radio experts. We give you Best Theory, Text-Books, and Two Instruments Free, the wonderful Omnigraph and

FREE VACUUM TUBE Wireless Phone AND CODE SET

Given Free with Professional Course.

Special Low Cost, Quick, Simple

AMATEUR WIRELESS COURSE

Qualifies For Amateur License

FREE Learn-O-Graph Code Sender given with Amateur Course.

Write for booklet "How to become a Wireless Operator."

NEW YORK WIRELESS INSTITUTE
154-V Nassau St. **New York City**

MAILING LISTS

For Sale

6300 Radio Dealers Retail	Per M., $7.50
318 Radio Manufacturers	4.00
644 Radio Supply Jobbers	7.50
14000 Amateur Radio Users	Per M., 7.50

Trade Circular Addressing Co.
166 W. Adams St. **Chicago, Ill.**
Phone Franklin 1182

TO BE SUNG, MURMURED OR CHANTED

The following touching poem is contributed by Paul M. Wilson, of Jackson, Tenn.:

I stretched my aerial—soldered ground,
Radio, My Radio;
I ran the wires both up and down,
Radio, My Radio;
I took great care right from the start,
To hook up radio is an art,
I'd put it up, then take apart,
Radio, My Radio.

I bought condensers, tube and wire,
Radio, My Radio;
The cost was high and getting higher,
Radio, My Radio;
Tubing, Amplifier, Phones,
I junked them all and now alone
My Westinghouse sits on the Throne,
Radio, My Radio.

Each night I listened in with you,
Radio, My Radio;
Each time you bring in something new,
Radio, My Radio;
KDKA each night I hear,
Chicago, too, comes in quite clear,
Detroit News just suits my ear,
Radio, My Radio.

Anyone with nerve enough may whistle the above to the wavelength of Maryland, My Maryland.

—*From Radio Broadcasting News.*

Our Radio

By S. E. KISER

OUR phonograph is silent now;
We never touch the thing,
Nor have the patience to allow
The canned quartettes to sing;
The radio has come to cheer
The wife and kids and me;
Too often, though, we seem to hear
The voice of *C O D.*

FROM *H A M* we daily get
Mark Antony's appeal,
From *D U B* a sermonette
Concerning woe and weal;
Next comes a lecture on the trick
Of writing movie scenes,
Or curing people who are sick,
Or baking pork and beans.

WE catch a joke from *F U N*
A speech from *S P Q;*
We get *R A Z* now and then,
Or pick up *Y O U;*
The children listen to the tales
The sandman tells at night,
Unless the static dingus fails
To sift the currents right.

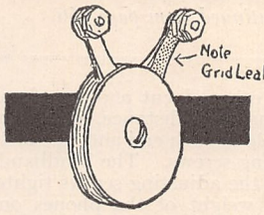
IT'S wonderful, superb, sublime,
A miracle, I'll say;
There's something doing all the time
To charm our cares away,
Except when visitors arrive,
And then there seems to be
No single station that's alive,
From *A* to *X Y Z.*

—*From N. Y. American*

SETBACK FOR THE TURKISH RADIO FAN

The Department of Commerce is advised by Trade Commissioner Gillespie that the President of the Allied Police Commission at Constantinople has published a notice prohibiting the sale of wireless apparatus in Constantinople and in the zone of Allied military occupation. The notice permits the sale of wireless apparatus outside of the zone occupied by the Allies, but requires firms wishing to make such a sale to obtain permission from Headquarters, Allied Police Commission, Constantinople, before making delivery of the goods, giving the name and full particulars concerning the buyer and of the destination of their apparatus.

Dependable Radio Products

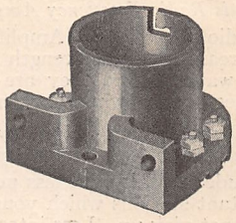


Benwood
"Universal" Condenser

An assembly of mica washers and thin copper plates. Can be used for grid, phone, filter, antenna, tapped or variable condenser. Standard set of six plates and ten washers, capacity, .0005 mfd., per set..... **75c**
Extra set of ten plates and ten washers, giving additional capacity of approximately .0005 mfd., per set.....40c

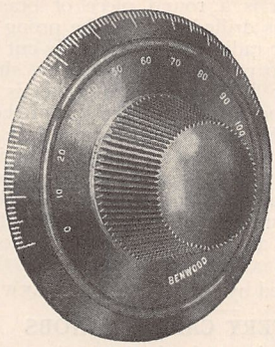
Ask for "Benwood" Parts

IT pays to be careful in the selection of every part that goes to make up your set—a few cents saved on mediocre parts may completely ruin the operation of the best set made. You can depend on "Benwood" products—a few are shown on this page—ask your dealer to show them to you, or if he cannot supply you, order direct by mail.



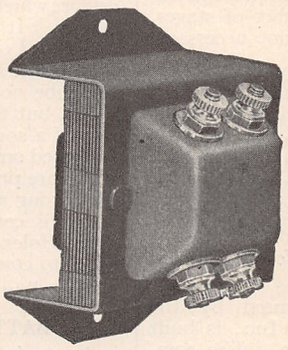
Benwood
V. T. Socket

Solid, highly polished, molded Bakelite. For either base or panel mounting. Firmly holds any standard four-prong vacuum tube. Eliminates ground hum and noises in operation of amplifiers. Terminal parts plainly marked. A good buy **$1.00**



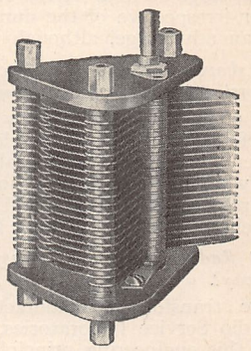
***Benwood* Bakelite Dial**

Solid Bakelite throughout—highly polished. Has extra large, tapered knob which fits the fingers perfectly. The knurling is particularly fine and sharp. Graduated 0° to 100°, all markings clearly defined in white and stamped into the solid Bakelite—won't wear off. Rib stops on reverse side prevents turning too far.
BC-7—Control, 4" diam., each.....$1.75
BC-8—Control, 3¼" diam., each.. **$1.50**



Benwood
Audio Transformer

Completely sheathed in metal—gives full 4 to 1 amplification without howling or squealing. Base is 2⅝" x 3⅜", height only 2 inches—ideal for either base or panel mounting. Core is best laminated steel, giving highest transference of energy. Each..... **$4.50**



Benwood
Variable Condenser

Note the improved stationary plate design—this condenser has the greatest capacity for overall size of any variable condenser made. Single bearing, wiping contact assures positive connections. Heavy aluminum plates will not bend or buckle. Bakelite ends. 43 plate, .0011 mfd. Each..... **$4.00**

DEALERS Write or wire for our attractive dealers' discounts on radio apparatus we manufacture—ready for immediate shipment.

CATALOG Send 10c in stamps for The Benwood catalog and price list, also complete catalog and price list of DeForest Radio Equipment.

The BENWOOD RADIO Co. INC.
"WORLD-WIDE MAIL ORDER SERVICE"
1111 Olive St. St. Louis, Mo.

Try **REYNOLDS RADIO** Service
(Old) 9 ZAF
from DENVER
IMMEDIATE DELIVERY
(New) KLZ

"ESCO" Motor Generators		CLAPP-EASTHAM	
400 V-100 Watt	$65.00	H R Receiver	$40.00
500 V-100 "	68.00	H Z 2-Step Amplifier	40.00
1000 V-500 "	185.00	R 3 MAGNAVOX	45.00

ABOVE PRICES F. O. B. STAMFORD

REYNOLDS RADIO CO., Inc. DISTRIBUTORS 1534 Glenarm St. **DENVER, COLO.**

MONEY for You Add to your Salary—Make extra Pin Money. Start a lucrative business of your own.
Spend an hour each day taking subscriptions for the "Radio News." We'll pay you well and you'll enjoy the work. Write for full particulars. Circulation Dept., RADIO NEWS, 53 Park Place, N. Y. C.

Radio Frequency Amplifying Transformers

What is Radio Frequency Amplification?

Radio Frequency Amplification is the increasing of the strength of radio signals or waves before they are applied to the detector tube, where they are made audible.

What results will I get by adding Radio Frequency Amplification to my set?

Louder signals with less noise in your set; distant stations which your detector alone cannot pick up. Less interference and less static disturbance, particularly if you use a loop indoor aerial.

Can Radio Frequency Amplification be added to any standard make of tube set to advantage?

Yes.

What must I add to my set to use Radio Frequency Amplification?

One radio transformer, one tube socket and one amplifier tube must be added for each stage desired. A 200 ohm potentiometer, irrespective of the number of stages, is an advantage, although not necessary.

How should a Radio Frequency Transformer be constructed to insure maximum efficiency?

An efficient radio frequency transformer is preferably built with a closed magnetic circuit to prevent undesirable oscillations or whistling sounds and should, therefore, employ an iron circuit and iron shielding to eliminate stray magnetic fields.

What Radio Frequency Transformer is built that way?

The transformer manufactured by the Radio Service Laboratories, Inc., is built on this engineering principle. The comminuted iron closed core (a special form of divided magnetic material) completely encloses the bobbin or transformer windings thus broadening the wave-length range, increasing the amplification per stage, shielding from stray magnetic fields, and eliminating capacity and leakage effects.

Where can I obtain this transformer?

At any electrical shop or store where Radio supplies are sold. If your nearest dealer does not carry it, write to the Rasla Sales Corporation, national distributors, 10 E. 43rd St., New York City, giving us the dealer's name and we will see that you are promptly supplied.

Big Opportunity

for 3 Live Wire Salesmen Selling Dealer Trade

RADIO Receiving Sets

We want three men who are fully acquainted with Radio apparatus to cover the dealer trade. Good starting salary. Excellent future for men who make good. Write, giving full details of experience.

Address DEPT. A, RADIO NEWS

Practical Hints for Amateur Constructors

(*Continued from page* 466)

screw to the other, I cut a piece of canvas 1½″ longer than this distance, and ¾″ wide. This had a hole in each end and was fastened to the adjusting screws. The headband was extended and the adjusting screws tightened. This left the weight of the phones on the canvas strip while the headband pressed the phones to the ears and at the same time left the user in comfort as the metal strips did not touch the top of the head.

Contributed by ARTHUR HANCE,
18 Bergen Street, Hackensack, N. J.

HOME-MADE V. T. SOCKET

The cheapest V. T. socket costs about a dollar, and it seemed to me there should be some way to make a less expensive one. The one I constructed has a special prong receiver which is a round piece of brass or copper. It is drilled to take the prong of a Moorhead or radiotron V. T. It is cut part way down to permit a little leeway, should the tube not fit exactly. No socket is provided, but the base is just the size of the inside of a socket and if one is desired, it may be forced on the base for a quarter of an inch. Holes are provided for screwing base to table. The prong receivers are screwed on the base, which is counterbored with a 1″ drill for a ¼″. Holes are provided for entrance of wires to connections. The base is ½″ thick.

Contributed by R. C. LEWIS.

BATTERY CAPS AS KNOBS

As teacher in a school where a large number of boys desired to build receiving sets, I needed quite a number of knob switches. We decided to make them and at first thought of turning them out of hard wood. Then filler caps from old storage batteries were suggested. The boys visited all the battery service stations in town and came back with about a hundred old filler caps or plugs. The ones best suited for our purpose were shaped as in Fig. 1, on page 466. These were sawed off at A-B, which left a hollow knob.

For the switch arm a piece of spring brass from the shell of an old alarm clock was cut the desired length and about 5/16″ wide and soldered to an 8/32 bolt, as shown at Fig. 2. This was held upright in the center of the hollow knob and some old sealing wax from the top of a dry battery poured in around the head of the screw, holding it very securely. A series parallel switch may be made by fitting a wooden plug into the hollow knob, and fastening the switch arms on with small wood screws, as shown in Fig. 3.

As an added precaution against the arm becoming loose, a notch is filled in the base of the knob just the width of the arm so that when the screws are tightened, the arms are held firmly down into these notches or slots.

Contributed by HENRY P. HOLMES,
433 Jacaranda Place, Fullerton, Cal.

New Radio Patents

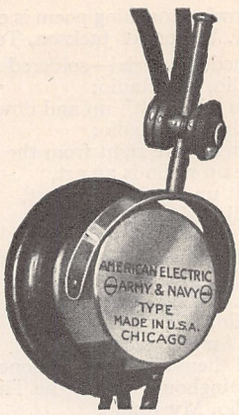
(*Continued from page* 452)

noted in these diagrams that the loop is connected in series with the primary of the transformer which is wound in sections around the iron core, 5. The secondary of the transformer is wound in sections between the primary as shown. The iron core of the transformer serves to couple the loop to the detector and also affords a by-path to earth for the core noises such as motors and ignition noises.

MODULATION SYSTEM

(Patent 1,404,756. Issued to Arthur M. Goldsmith, New York. January 31, 1922.)

This invention relates to radio transmitting systems and more particularly to the controlling of the amplitude of the current supplied through a high



American Electric

HIGH GRADE

HEAD SETS

Army and Navy Type:
2500 OHM, PER PAIR, $10.00
3200 OHM, PER PAIR, 12.00

Swedish-American Type:
2200 OHM, PER PAIR, . 8.00

American Electric
COMPANY
CHICAGO

NOVO "B" BATTERIES FOR RADIO

22½-45 & 105 VOLTS

NOISELESS
DEPENDABLE
GUARANTEED

ASK YOUR DEALER

NOVO MANUFACTURING CO.
424-438 W. 33rd ST.
NEW YORK

531 SO. DEARBORN ST., CHICAGO.

FROM CAT WHISKERS UP—

We can supply everything that's best in Radio, 1 or 101 of any article to user or dealer. Same day shipments.

Inquiries are welcome

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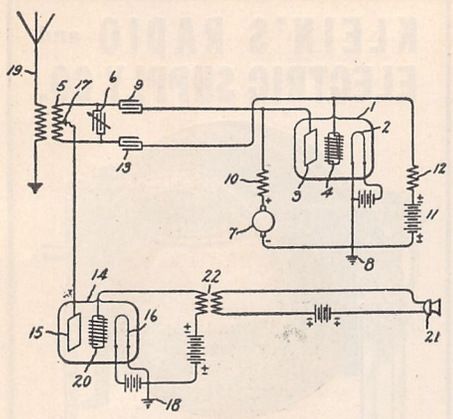
DISTRIBUTORS
Wholesale & Retail
Westinghouse
Brandes Federal
Murdock, DeForest
Radio Corporation
and many others

AT EAST PITTSBURGH, PA.—NEXT DOOR TO KDKA



A New Modulation System for a Tube Set.

frequency circuit to an antenna for the purpose of transmitting signals or speech.

When an oscillating loop circuit is supplied with a constant potential generator it is well-known that a variation of the resistance of the lead will not effect the current flowing in the circuit; it is not practical to secure a feed control of the current in such a circuit merely by varying its resistance. In carrying out this invention, the variable resistance device is coupled in series with the circuit which feeds energy to the loop circuit.

In the drawing, the pliotron, 1, is used to produce radio frequency oscillations; plate and grid are connected to the loop circuit comprising the inductance, 5, and variable condenser, 6. The feed circuit for the resonance loop circuit is completed through a single tube, 14. The plate of this is connected to the inductance, 5, and the filament of which is grounded at 18.

If it is desired to modulate the radio frequency output to the antenna, it is not possible to do so by varying the resistance of the oscillating circuit. This difficulty may be overcome by varying the resistance of the feed circuit. In the arrangement shown, this may conveniently be accomplished by varying the resistance of the modulating tube, by varying the potential of its grid in accordance with the signals to be transmitted. This is accomplished in the usual manner and, in this case, is shown by a microphone to which batteries are connected through the primary of the modulation transformer.

LOUD SPEAKER FROM AUTO HORN

Every fan sooner or later will want to add a loud speaker to his set to allow the rest of the family to hear the music, but, owing to the price, many are forced to abandon the idea. The type of loud speaker illustrated in the accompanying diagram is easily built for a small sum and has given good results. The only material required is an old automobile horn, as shown in Fig. 1, which may be purchased at a junk shop for a small amount, and enough good wood, free from knots, to construct the cabinet. The size of the cabinet will be a matter of choice, depending upon the proportions of the receiver. A hole, the size of the bell of the horn, should be drilled in the front piece, to permit the horn to be flush with the panel. Care should be taken not to make the hole too large or uneven. The cabinet should be stained and finished to obtain a good appearance. The front

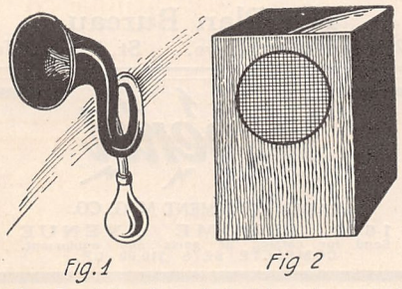
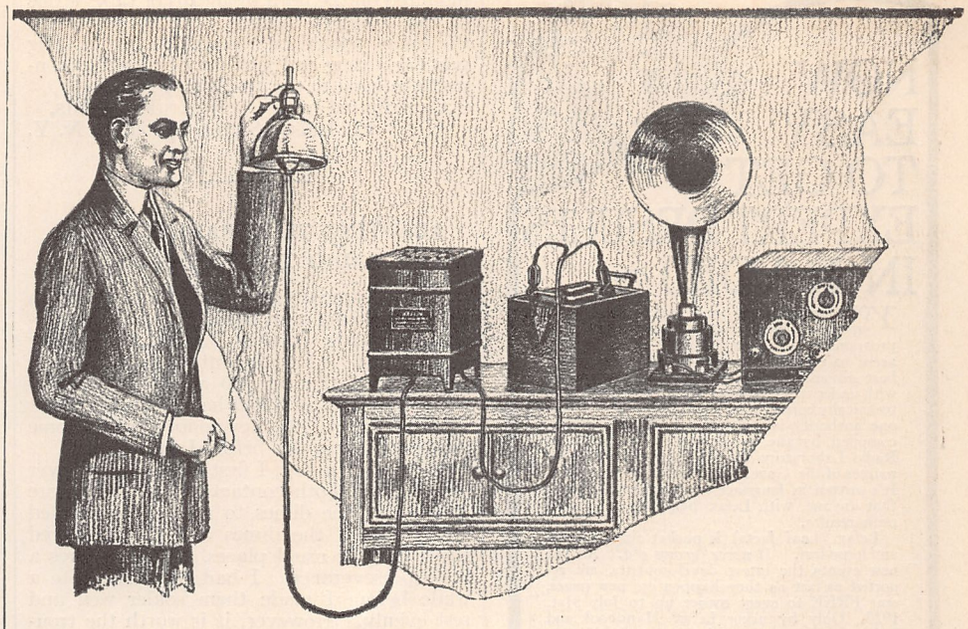


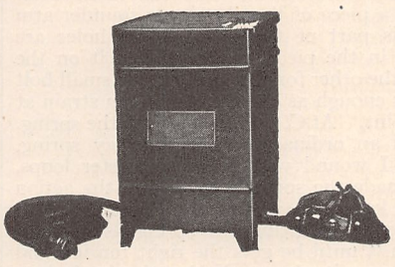
Fig. 1 Fig 2

Another Loud Speaker. It is Made from an Old Bulb Type Automobile Horn.

panel may be of bakelite, in which case the loud speaker will resemble the remainder of the apparatus. The inside of the horn should be enameled or the hole may be covered with a piece of fine silk or copper mesh, as shown in Fig. 2. This will enhance the appearance of the horn considerably.

The best type of receiver to use is the single Baldwin unit type C. This should be





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BLANDIN TRIPLE A

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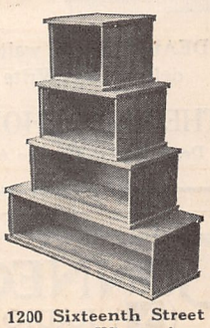

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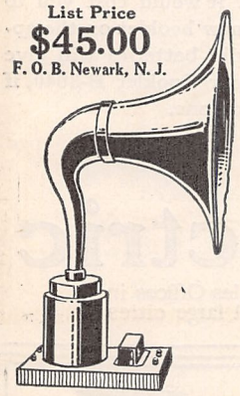

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mounted on the horn by means of tape or one of the standard adapters. The leads from the phone should be brought to two binding posts or a plug and jack may be used to connect the horn to the amplifying panel.

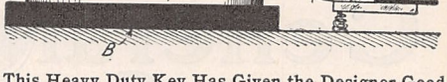
Contributed by Jos. KAUKONIS,
123 Halsey Street, Brooklyn, N. Y.

ADAPTING TELEGRAPH KEY FOR RADIO TRANSMISSION

The accompanying illustration shows a good method of converting an ordinary telegraph or light wireless key into a regular heavy duty, easily operated, wireless key. I have used this on 500 watts continually for quite some time and have found no fault with it as yet. This key is not a bit tiresome to operate, as it was before I changed it.

To make the key, I first removed the lever and filed off both contacts, to present more surface for the dimes to rest upon. I filed both sides of the dimes and then soldered them in their usual places. This requires a little perseverance. I had to work quite a while before I made them solder well and rest evenly. However, it is worth the trouble. When the contacts have been soldered on properly, the extension arm is put in position. This consists of a piece of square metal, about ¼" x ¼" x 2". I have used many different rods and strips, but these dimensions work the best. Of course one can vary the length to suit individual taste. I used a piece of the aluminum sounder arm for this part of the lever. Two holes are drilled in the piece, one to fasten it on the lever, the other for the knob. One small bolt at C is enough as there is not much strain at this point. At C, also, is fastened the spring. I used an ordinary telegraphic key spring, which I wound with larger diameter loops. This made the spring weaker and the action of the key more resilient. I have provided no way of adjusting the spring as one can stretch it until he gets the right tension and then leave it alone. Under the knob is a hard rubber or fibre disc, about 2" in diameter, on which to rest the fingers. This key will handle heavy currents and by moving the spring from A to C and the addition of the arm, it becomes easy to operate without making as many mistakes as before. The whole key should be mounted on a neat, wooden base to prevent the arm from hitting the table.

Contributed by RUDOLPH LAPP,
72 Wolcott Street, Leroy, New York.



This Heavy Duty Key Has Given the Designer Good Service. It is Made from a Telegraph Key.

Iron Conduit for Lead In Wire

(*Continued from Page 442*)

fashion, to a point about 60' distant. A duplex conductor was used and run the entire distance.

The connections were made as indicated in Fig. (1). The set was a vario coupler, two variometer, with two stages of audio amplification and very satisfactory results were obtained.

The connections indicate the theory very clearly, for it will be seen that while the in-

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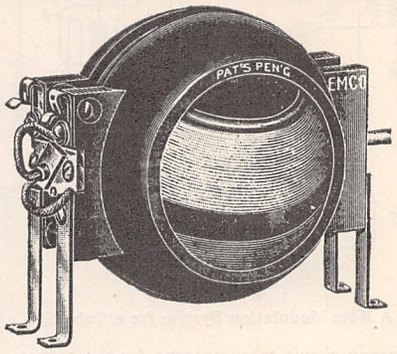

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duced E. M. F. is the same in both wires, one wire goes directly to the ground and the other has a phase difference due to current being adjusted to resonance; hence mutual inductance exists between the two wires and self inductance of the lead-in is eliminated.

A similar experiment was conducted with a one-wire aerial and the idler wire was run up to the roof in conduit with the lead-in. Sometimes it was possible to get easier tuning with the idler wire hooked to the antenna connection on the set and to have the aerial run straight to the ground, but in every case clear signals were obtained with two active wires, whereas with one wire alone they were not audible. There are many possible connections such as interposing condensers or inductances in the idler wire, but the fact that lead-in wires may be run in conduit without regard for steel members of steel buildings will doubtless appeal to many amateurs who look upon bare wires as fire hazards.

Who's Who in Radio

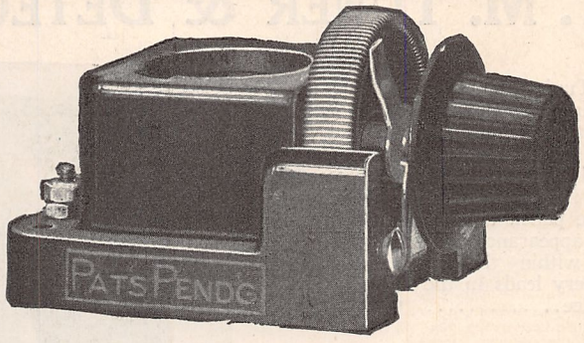
(*Continued from page* 450)

"His demonstration of 1875 seems beyond doubt to have been the very first discovery, by means of repeated tests at large and varying distances, of the transmission of the invisible electro-magnetic waves through the ether, the first experimental discovery of what are generally known as the Hertz-Maxwell waves, now so widely used in wireless telegraphy and telephony."

Prof. Elihu Thomson was born in England in 1853 and came to this country with parents at the age of five. He was graduated from the Central High School, in Philadelphia, in 1870, and became professor of chemistry there in 1876. His first important invention was the three-coil arc dynamo which formed the basis of the successful lighting system put out by the Thomson-Houston Electric Co. in 1880. Many of his early researches and inventions were made in collaboration with his former associate in the High School, the late E. J. Houston.

The Thomson-Houston Electric Co., established in Philadelphia in 1879, removed in 1880 to New Britain, Conn., and in 1883, when a Lynn syndicate bought control, the business was removed to Lynn where, with more complete equipment, the Thomson-Houston enterprise was built up to great prominence. In 1892, by merger with the Edison General Electric Co., the General Electric Co. was formed. During the pioneer days Prof. Thomson was electrician and chief engineer, and many of the fundamentally important inventions upon which the industry was based are his. Prof. Thomson's inventions touch all angles of electrical application and his United States patents alone exceed six hundred.

Yale, Tufts and Harvard have honored Dr. Thomson with degrees. He received from the French government the decorations of Chevalier and Officer of the Legion of Honor; he was awarded the Rumford Medal in 1901, the Grand Prix at the Paris Exposition in 1889 and 1900, and was the first recipient of the Edison Medal for electrical engineering in 1910; the Franklin Institute awarded him the Elliott Cresson gold medal and he twice received the John Scott Legacy medal. The John Fritz medal, founded by the four great national engineering societies was awarded him in recognition of his achievements in electrical invention and scientific research.—*Text and illustrations by courtesy of the General Electric Co.*



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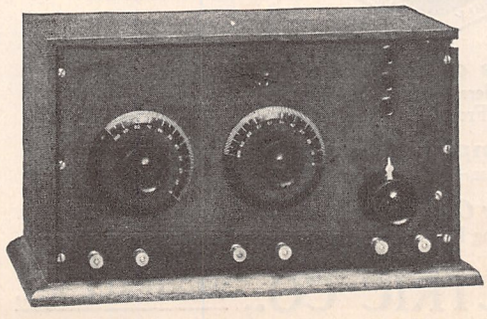

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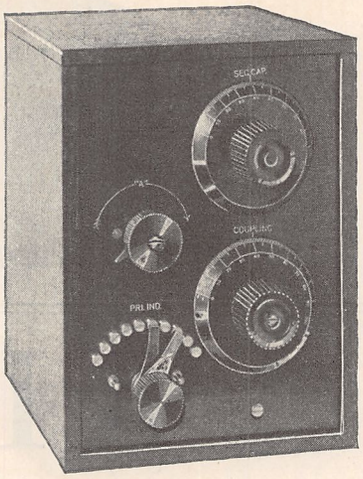

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PROPOSITION TO DEALERS **SEND 6c FOR CATALOGUE**

The New Radio Bill

(*Continued from page* 450)

point and this is a proviso which makes permits necessary before construction of a commercial and private station is started. For reasons which are obvious in broadcasting, such a feature is desirable at the present time and it should stand.

While this bill does not mention the radio amateur at all, it should be understood that the bill is only an amendment to the already existing law. Regulation 15 gives to the amateur a broader band or wave length, namely, from 150 meters to 275 meters. We believe the amateurs will be satisfied with this, but the regulation should be a little more explicit, defining the status of the amateur more fully. We believe when this is done then the amendment, coupled with the present radio law, will probably be accepted as satisfactory by the Amateur Fraternity.

Read the bill through carefully and if you find any objections, the editor will be glad to have your communication.

S. 3694

IN THE SENATE OF THE UNITED STATES

APRIL 20 (calendar day, JUNE 8), 1922

Mr. KELLOGG introduced the following bill; which was read twice and referred to the Committee on Interstate Commerce.

A BILL

To amend an Act to regulate radio communication, approved August 13, 1912, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Act of Congress entitled "An Act to regulate radio communication," approved August 13, 1912, is amended by striking out sections 1, 2, and 3 thereof and by inserting in lieu thereof the sections 1, 2, and 3 following:

"SECTION 1. A. That no person, company, or corporation within the jurisdiction of the United States shall use or operate any apparatus for radio communication by telegraphy or telephony as a means of intercourse among the several States or with foreign nations, or upon any vessel of the United States engaged in interstate or foreign commerce, or for the transmission of radiograms or signals by telegraphy or telephony the effects of which extend beyond the jurisdiction of the State or Territory in which the same are made, or where interference would be caused thereby with the transmission or reception of messages or signals from beyond the jurisdiction of said State or Territory, except under and in accordance with a license in that behalf granted by the Secretary of Commerce and except as hereinafter authorized.

"B. That the Secretary of Commerce from time to time shall (a) classify licensed radio stations and the operators required therein; (b) prescribe the nature of the service to be rendered by each class of licensed station and assign bands of wave lengths thereto; (c) make, alter, and revoke regulations applicable to all licensed stations not inconsistent with this Act or any other Act of Congress or with the terms of any radio communication convention to which the United States is a party concerning the service to be rendered by each class of stations so established; the location of any station; the wave lengths to be used by any station; the kinds of instruments or apparatus in any station with respect to the external effect produced thereby; the power and the purity and sharpness of the waves of each station or the apparatus therein; the area to be served by any station and the times and methods of operating any station or the apparatus therein; (d) make such other regulations not inconsistent with law as he may deem necessary to prevent interference between all stations affected by this Act.

"C. That radio stations belonging to and operated by the United States and used exclusively for communication of official business shall not be subject to the provisions of paragraphs A and B of this section. Every other station owned and operated by the United States shall be subject to the provisions of said paragraphs A and B of this section. All stations owned and operated by the United States and all other licensed stations on land or sea shall have special call letters designated by the Secretary of Commerce, and such stations and the designated call letters shall be included in the list of radio stations of the United States as published by the Department of Commerce. Radio stations owned and operated by the United States and used exclusively for the communication of official business shall use such wave lengths as shall be assigned to each by the Presi-

dent, and shall observe such regulations as the Secretary of Commerce may make to prevent undue interference with other radio stations and the rights of others, except that upon proclamation by the President that there exists war or a threat of war or a state of public peril or disaster, or other emergency, the President may suspend for such time as he may see fit all such regulations of the Secretary of Commerce applicable to such stations owned and operated by the United States.

"D. That every such license shall provide that the President of the United States in time of war or public peril or disaster may cause the closing of any station for radio communication and the removal therefrom of all radio apparatus, or may authorize the use or control of any such station or apparatus by any department of the Government upon just compensation to the owners.

"SEC. 2. A. That paragraph A of section 1 of this Act shall not apply to persons sending radio messages or signals through a radio station belonging to and operated by the United States for the transmission exclusively of official business nor to persons sending such messages on a foreign ship while the same is within the jurisdiction of the United States.

"B. That the station license required hereby shall not be granted to, or after the granting thereof such license shall not in any manner, either voluntarily or involuntarily, be transferred to (a) any alien or the representative of any alien; (b) nor to any foreign government or the representative thereof; (c) nor to any company, corporation, or association organized under the laws of any foreign government; (d) nor to any company, corporation, or association of which any officer or director is an alien or of which more than one-fifth of the capital stock having voting power is owned or controlled by aliens or their representatives or by a foreign government or representative thereof, or by any company, corporation, or association organized under the laws of a foreign country.

"Such station license, the wave length or lengths authorized to be used by the licensee, and the rights therein granted shall not be transferred, assigned, or in any manner, either voluntarily or involuntarily, disposed of to any other person, company, or corporation without the consent in writing of the Secretary of Commerce.

"C. That the Secretary of Commerce, subject to the limitations of this Act, in his discretion, may grant to any applicant therefor a station license provided for in sections 1 and 2 hereof, except that he may grant such license only to a station which is in the interest of the general public service.

"No license granted by the Secretary shall be for a longer term than 10 years, and any license granted may be revoked as hereinafter provided. Upon the expiration of any license the Secretary, in his discretion upon application therefor, may grant a renewal of such license for the same or for a lesser period of time.

"The Secretary of Commerce is hereby authorized to refuse a license to any person, company, or corporation, or any subsidiary thereof which, in the judgment of the Secretary, is monopolizing or seeking to monopolize radio communication, directly or indirectly, through the control of the manufacture or sale of radio apparatus or by any other means. The granting of a license shall not estop the United States from prosecuting such person, company, or corporation for a violation of the law against monopolies or restraint of trade.

"D. That the Secretary of Commerce may grant licenses only upon written application therefor addressed to him, which application shall set forth such facts as he by regulation may prescribe as to the citizenship, character, and financial, technical, and other ability of the applicant to operate the station; the ownership and location of the proposed station and of the stations with which it is proposed to communicate; the wave lengths and the power desired to be used; the hours of the day or other periods of time during which it is proposed to operate the station; the purposes for which the station is to be used, and such other information as he may require. Such application shall be signed by the applicant under oath or affirmation.

"E. That such station license as the Secretary of Commerce may grant shall be in such general form as he may prescribe, but each license shall contain in addition to other provisions a statement of the following conditions to which such license shall be subject: (a) The ownership or management of the station or apparatus therein shall not be transferred in violation of this Act. There shall be no vested property right in the license issued for such station or in the bands of wave length authorized to be used therein, and neither the license nor any right granted thereunder shall be assigned or otherwise transferred in violation of this Act; (b) such licenses shall contain such other conditions, not inconsistent with this Act, as the Secretary of Commerce may prescribe.

"F. That any station license granted by the Secretary of Commerce shall be revocable by him for failure to operate service substantially as proposed in the application and as set forth in the license, for violation of or failure to observe any of the restrictions and conditions of this Act or of any regulation of the Secretary of Commerce authorized by this Act or by the provisions of any international radio convention ratified or adhered to by the United States or any regulations thereunder, or whenever the Secretary of Commerce shall deem such revocation to be in the public interest: Provided, That no order of revocation shall take effect until thirty days' notice in writing

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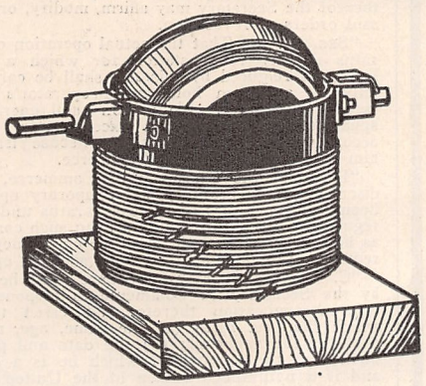

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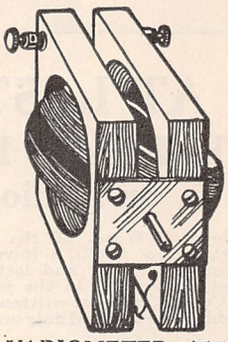

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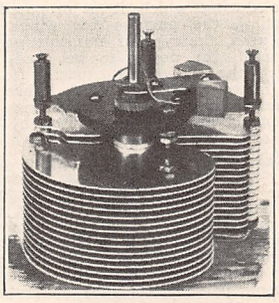

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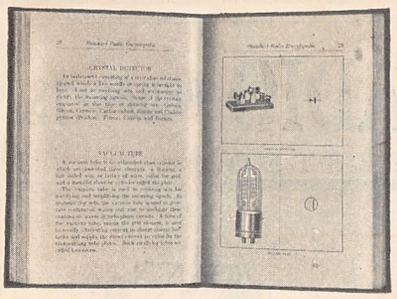

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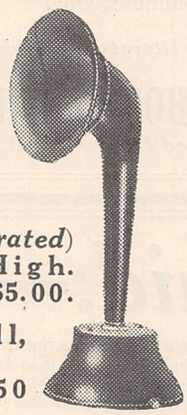

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thereof to the parties known by the Secretary to be interested in such license. Any person in interest, aggrieved by said order, may make written application to the Secretary at any time within said thirty days for a hearing upon such order and upon the filing of such written application said order of revocation shall stand suspended until the conclusion of the hearing herein directed. Notice in writing of said hearing shall be given by the Secretary to all the parties known to him to be interested in such license twenty days prior to the time of said hearing. Said hearing shall be conducted under such rules and in such manner as the Secretary may prescribe. Upon the conclusion thereof the Secretary may affirm, modify, or revoke said orders of revocation.

"Sec. 3. A. That the actual operation of apparatus in any radio station for which a station license is required by this Act shall be carried on only by a person holding an operator's license issued thereunder. No person shall operate any apparatus in such station except under and in accordance with an operator's license issued to him by the Secretary of Commerce.

"B. That the Secretary of Commerce, in his discretion, may grant special temporary operators' licenses to operators of radio apparatus under such regulations, in such form, and upon such conditions as he may prescribe whenever an emergency arises requiring prompt employment of such an operator.

"C. That an operator's license shall be issued by the Secretary of Commerce in response to a written application therefor, addressed to him, which shall set forth (a) the name, age, and address of the applicant; (b) the date and place of birth; (c) the country of which he is a citizen; and if a naturalized citizen of the United States, the date and place of naturalization; (d) the previous experience of the applicant in operating radio apparatus; and (e) such other facts or information as may be required by the Secretary of Commerce. Every application shall be signed by the applicant under oath or affirmation.

"D. That an operator's license shall be issued only to a person who, in the judgment of the Secretary of Commerce, is proficient in the use and operation of radio apparatus and in the transmission and reception of radiograms by telegraphy and telephony. Except in an emergency found by the Secretary of Commerce to exist, an operator's license shall not be granted to any alien, nor shall such a license be granted to a representative of a foreign government.

"E. That an operator's license shall be in such form as the Secretary of Commerce shall prescribe, and may be suspended by him for a period not exceeding two years upon proof sufficient to satisfy him that the licensee: (a) has violated any provision of any act or treaty which the Secretary of Commerce is authorized by this Act to administer, or of any regulation made by the Secretary under any such act or treaty; or (b) has failed to compel compliance therewith by any unlicensed person under his supervision; or (c) has failed to carry out the lawful orders of the master of the vessel on which he is employed; or (d) has wilfully damaged or permitted apparatus to be damaged; or (e) has transmitted superfluous signals, or signals containing profane or obscene words or language.

"F. That a license may be revoked by the Secretary of Commerce upon proof sufficient to satisfy him that the licensee was at the date his license was granted to him, or is at the time of revocation, ineligible for a license.

"Sec. 4. A. That after the approval of this Act the construction of a station for which a license is required by this Act shall not be begun, nor shall the construction of a station already begun be continued, until after a permit for its construction has been granted by the Secretary of Commerce upon written application therefor. This application shall set forth such facts as the Secretary of Commerce by regulation may prescribe as to the citizenship, character, and the financial, technical, and other ability of the applicant to construct and operate the station, the ownership and location of the proposed station and of the station or stations with which it is proposed to communicate, the wave length or wave lengths desired to be used, the hours of the day or other periods of time during which it is proposed to operate the station, the purpose for which the station is to be used, the type of transmitting apparatus to be used, the power to be used, the date upon which the station is expected to be completed and in operation and such other information as the Secretary of Commerce may require. Such application shall be signed by the applicant under oath or affirmation.

"B. That such permit for construction shall show specifically the earliest and latest dates between which the actual operation of such station is expected to begin and shall provide that said permit will be automatically forfeited if the station is not ready for operation within the time specified. The rights granted under any such permit shall not be assigned or otherwise transferred to any other person, persons, company, or corporation, without the approval of the Secretary of Commerce: Provided, That a permit for construction shall not be required for Government stations to be used exclusively for communication of official business or for private stations as provided for in section 4, fifteenth regulation, of the Act of August 13, 1912. The granting of this permit to construct a station as herein required shall not be construed to impose any duty or obligation upon the Secretary to issue a license for the operation of such station.

"Sec. 5. That an advisory committee is hereby established to whom the Secretary of Commerce

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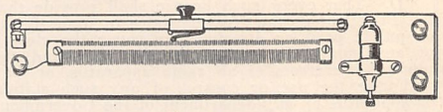

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shall refer for examination and report such matters as he may deem proper relating to: (a) the administration or changes in the laws, regulations, and treaties of the United States relating to radio communication; (b) the study of the scientific problems involved in radio communication with a view of furthering its development; (c) the scientific progress in radio communication and use of radio communication.

"The advisory committee shall consist of twelve members, of whom one shall be designated by the Secretary of State, one by the Secretary of War, one by the Secretary of the Navy, one by the Secretary of Agriculture, one by the Postmaster General, and one by the Secretary of Commerce, to represent these departments, respectively, and six members of recognized attainment in radio communication not otherwise employed in the Government service to be designated by the Secretary of Commerce.

"The necessary expenses of the members of the committee in going to, returning from, and while attending meetings of the committee, including clerical expenses and supplies, together with a per diem of $25 to each of the six members not otherwise employed in the Government service for attendance at the meetings, shall be paid from the appropriation made to the Department of Commerce for this purpose.

"SEC. 6. That radio telephone stations, the signals of which can interfere with ship communication, are required to keep a licensed radio operator, of a class to be determined by the Secretary of Commerce, listening in on the wave length designated for distress signals during the entire period the transmitter of such station is in operation.

"SEC. 7. That regulation first of section 4 of said Act of Congress approved August 13, 1912, is amended by striking out the words 'this wave length shall not exceed six hundred meters or it shall exceed one thousand six hundred meters.'

"Regulation second of section 4 of said Act of Congress approved August 13, 1912, is amended by striking out the words 'provided that they do not exceed six hundred meters or that they do exceed one thousand six hundred meters.'

"Regulations third and fourth of section 4 of said Act of Congress approved August 13, 1912, are hereby repealed.

"Regulations fifteenth and sixteenth of section 4 of said Act of Congress approved August 13, 1912, are amended by striking out the words 'exceeding two hundred meters' and substituting in lieu thereof the words 'of not less than one hundred and fifty meters nor more than two hundred and seventy-five meters.'

"SEC. 8. That any person, company, or corporation who shall erect, use, or operate any apparatus for radio communication in violation of this Act, or knowingly aid or abet another person, company, or corporation in so doing, or knowingly make any false oath or affirmation for the purpose of securing a permit or a license, shall incur a penalty not to exceed $1,000, which may be mitigated or remitted by the Secretary of Commerce, and the permit or license of any person, company, or corporation who shall violate any of the provisions of this Act, or of any of the regulations of the Secretary of Commerce issued hereunder, or knowingly make any false oath or affirmation for the purpose of securing a permit or license, may be suspended or revoked by the Secretary of Commerce.

"SEC. 9. That the Secretary of Commerce is hereby authorized and directed to charge, and through the imposition of stamp taxes on applications, licenses, or other documents, or in other appropriate manner, to collect, the fees specified in the schedule following. The Secretary shall collect said fees through the collectors of customs or other officers designated by him, and he may make such regulations as may be necessary to carry out the provisions of this section.

"SCHEDULE OF FEES TO BE COLLECTED.

"For transoceanic radio station license, $300 per annum; for commercial land station license, other than transoceanic, one kilowatt transmitter input or less, $50 per annum; and for each additional kilowatt or fraction thereof $5 per annum; for ship station license, $25 per annum; for experiment station license, $25 per annum; for technical and training school station license, $15 per annum; for special amateur station license, $10 per annum; for general and restricted amateur station license, $2.50 per annum; for commercial extra first-class operator's license, $2.50 per annum; for commercial first-class operator's license, $1.50 per annum; for commercial second-class operator's license, $1 per annum; for commercial cargo grade operator's license, 50 cents per annum; for experiment and instruction grade operator's license, $1 per annum; for amateur first-grade operator's license, 50 cents per annum; for amateur second-grade operator's license, 50 cents per annum; for commercial extra first-class radio operator's examination for license, $2.50 for each examination; for commercial first-class radio operator's examination for license, $2 for each examination; for commercial second-class radio operator's examination for license, $1.50 for each examination; for commercial cargo grade radio operator's examination for license, $1 for each examination; for experiment and instruction grade radio operator's examination for license, $1 for each examination; for amateur first-grade radio operator's examination for license, $1 for each examination; for amateur second-grade radio operator's examination for license, 50 cents for each examination.

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"For failure to pay at the time and in the manner specified by the Secretary of Commerce any of the above fees the Secretary of Commerce is authorized to refuse to issue such licenses; or if issued, to suspend or revoke the same, as he may deem proper.

"SEC. 10. That wherever the words 'naval and military' stations appear in the Act to regulate radio communication, approved August 13, 1912, said words 'naval and military' shall be stricken out and the word 'Government' substituted in place thereof.

"SEC. 11. That all Acts or parts of Acts in conflict with this Act are hereby repealed."

Why Radio Sales Fall Off

(*Continued from page* 429)

phlets, and in one shining case for twenty-five cents I received six sheets of paper, six by nine, from a concern that is rated high, and considered a reliable house.

Recognizing in this the good old "gouging" days of the war, I let it pass and proceeded to order what I wanted. This was several months ago, and when I placed my orders I immediately received postcards telling me not to worry. The stuff would come in time. And it is still coming in dribs; and, of course, the most essential things are yet to come. So much for the mail-order end of it.

I went into the retail stores in Philadelphia and attempted to fill out my needs there, but I had to battle with clerks who knew no more about radio than they did about the Einstein theory. They could not tell me a thing about the products they were selling, and in every instance I had to sell myself what I bought. In one instance, when I tried to get a condenser of well-known make, some of the parts were missing, and I was assured by the clerk that that was all there was to it. If I had not known exactly what I wanted, I would have been sold a bunch of junk, but I insisted and another clerk finally found what I desired.

In another store I bought a set of telephone receivers and also a plug, with the assurance that the receivers would fit the plug. I foolishly did not try it there, and when I got home I found they did not fit at all.

Such purchases as I did make—and I am building an outfit that has already run over $300—I found that the manufacturers gave as scant help as possible. Screws and bolts were almost invariably missing and this would mean I had to go to a dozen stores before I could get the exact size bolt or screw that was needed to go on that particular piece. Packing has been completely forgotten, delicate apparatus being apparently delivered to the retailers like a basket of potatoes.

Noticing the full-page advertisement of another manufacturer, I wrote him and asked him who handled his supplies in Philadelphia, and he gave me the name of a large department store. I went there on a very hot day, with a railroad trip of twenty miles, only to be told that this department store had long since put in their order, but had received nothing. I wrote the manufacturer and he wrote me a very nice letter. He said the department store had evidently been sold out of what had been delivered. He also added that he was sending me with his compliments some of his dials. They never came. I am inclined to believe the department store and not the manufacturer.

In another case I bought another advertised piece at $4.25. At the same time I wrote a letter asking for wiring directions. No reply was received to the letter, but I did get the

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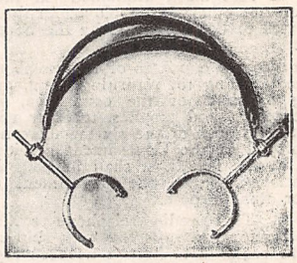

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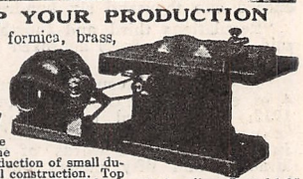

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instrument. I finally wired it after several hours' work and then in placing the knob, which was a very cheap affair, the set screw broke and the instrument was made worthless. I immediately wrote the manufacturer and offered to buy another knob if he would send it to me immediately. I never received any reply to this. That lost the sale of at least six of these instruments among my friends, who were waiting to find out how it worked on my apparatus.

There are a few shining exceptions to the foregoing, one is a rheostat—bearing a special trade name—carefully packed, in which the manufacturer gives printed instructions. Another is a line of variometers and transformers, put out by a Philadelphia manufacturer, where the packing is carefully done, and where in reply to a letter of mine, inquiring as to wiring instructions, somebody made a pencil sketch and wrote that they would follow my suggestion and put such a chart with other purchases thereafter.

Oh, yes, I almost forgot the knobs and dials. If you know of one of these that is made where the manufacturer has taken the trouble to thread the set screw all the way through, I will be interested in having his name. Of about eight different makes I have bought or examined, the threading is only partially done—just enough to let a small set screw get into the top, and when you try to force the threading through, so as to make the latter serve its purpose, the head breaks off and the whole thing is no good.

Now, Mr. Editor, instead of worrying about the manufacturers' troubles, take my advice; if the radio business is to stay, it must find out something about the novices' troubles and then hammer it into the heads of the manufacturers so they will not blame their advertising men because of poor results.

It is a well-known fact that the South-American trade went to foreign manufacturers because they sent men into that country who studied the conditions. These men learned there were no railroads, and goods shipped in big cases could not get into the interior. Therefore all stuff going into the interior had to be put into small cartons. These foreign manufacturers immediately packed their stuff so that it could be carried by the mules and llamas, and these foreigners got the bulk of the business, while the stupid American manufacturers cussed away at the South-Americans because they did not place their business here. The American manufacturers insisted on shipping their goods packed the same as they pack them for United States railroads.

It is just this sort of thing in business that brings about the conditions over which the business men lament so much. And I can assure you from the talks that I have had with many friends who were once originally interested in radio, that it is just this sort of unwillingness on the part of the American radio manufacturers and dealers that can ruin that particular business.

INEXPENSIVE CURRENT FOR YOUR VACUUM TUBES

Recently a friend of mine expressed the desire to own a more practical set than the one he then had, which consisted of a crystal receiver of well-known make. I suggested a vacuum tube detector and one-step amplifier. As this gentleman owns a car, it occurred to me that the battery in the car could be put to use, so a plug was secured which would fit into the socket of the dash lamp, and attached to this was a length of Duplex cable, or lamp cord, which was run from the garage to the house and attached to the receiver. When the car is to be used, the plug is removed and hung on the wall of the garage.

Care must be taken, in the event of cars equipped with 12-volt batteries, to place a resistance in circuit to allow for control of the tubes with a filament rheostat. An extra field rheostat will do for this purpose.

Contributed by P. W. BABBITT,
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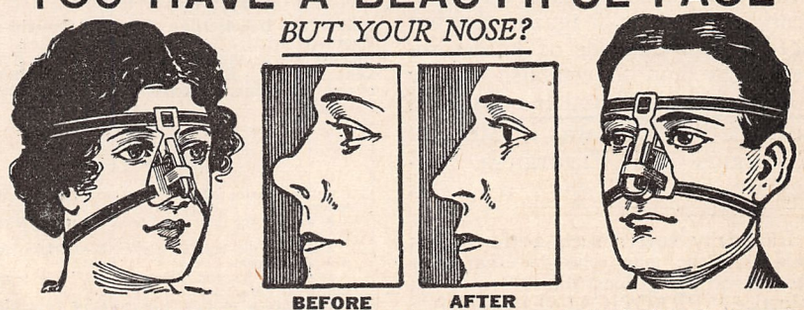

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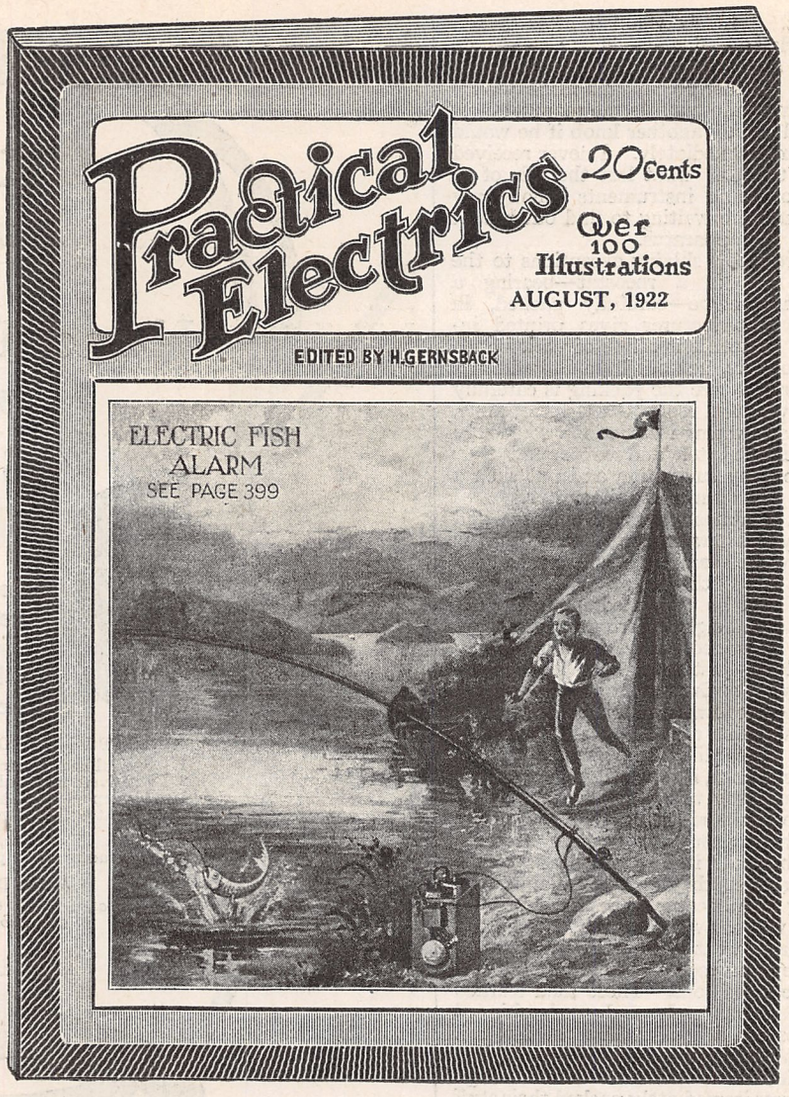

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R. N. 9-22

A Method of Amplifying Electrical Variations of Low Frequency

(*Continued from page* 440)

currents used with any indicating instrument or with a telephone receiver; or amplified modulated currents may be passed directly to a thermal indicating instrument or to a thermal telephone.

The method was very successful with speech currents, the articulation being quite unimpaired by the whole amplifying process. It promises to be successful also for magnification of currents or voltages varying relatively slowly—such currents as are met with, for instance, in the physiological laboratory. But the writers have not had the opportunity of testing the strictness of the proportionality between the voltage applied for modulating the radio oscillations and the resulting rectified current at the extreme end of the chain of operations.

The Development of Radiophone Broadcasting

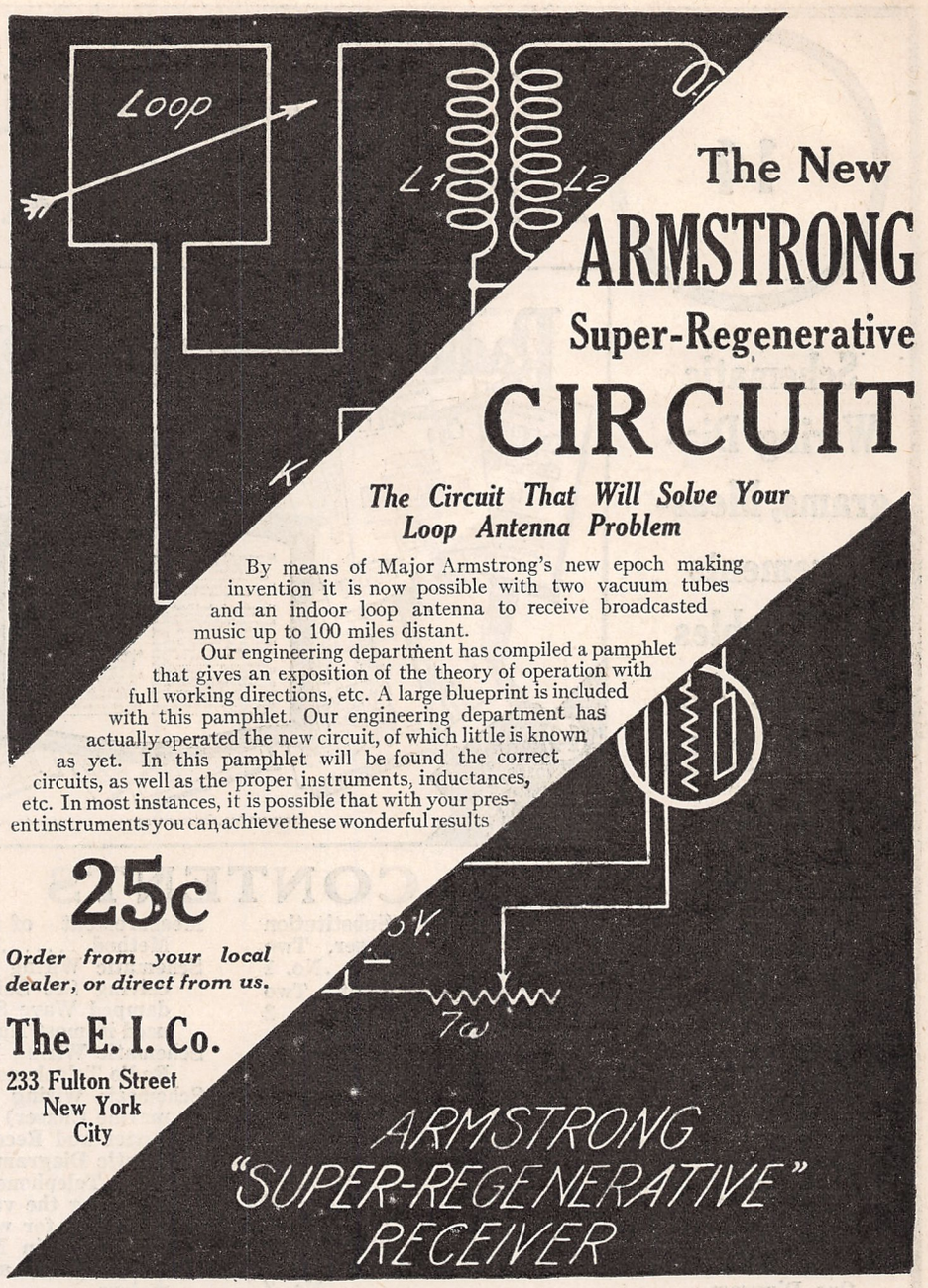
(*Continued from page* 469)

and probably there were fewer amateur stations after than before the war.

During the war, Mr. Frank Conrad, Assistant Electrical Engineer for the Westinghouse Electric & Manufacturing Company, had become interested in radio work because he had given his best efforts to assist the Government in producing the very highest type of radio equipment for the Army and Navy. Practically the only type of equipment which was produced in quantity and delivered in France in time to be of any service to the American troops and which met the requirements of warfare was an airplane transmitter known as SCR-73 set, developed and produced by this company and its subsidiaries. Mr. Conrad's activities covered, however, more than this equipment as he was also interested in the development of various types of radio telephone sets. To aid him in his experiments he was given a special license to operate during the war a radio telephone at his home at Pittsburgh, Pa.

After the Armistice he retained his interests in his work and, operating under this special license was able to continue development of his radio telephone station to a degree of success exceeding anything heretofore attained. The Westinghouse Company, which, previous to the war, had no radio interests, also decided that a company of its magnitude could no longer exclude radio from its activities and had entered this branch of the electrical business. It was intensely interested in Mr. Conrad's researches and he continued his work with its encouragement and assistance.

In the winter of 1919 Mr. Conrad established at his residence in Pittsburgh, Pennsylvania, a radio telephone broadcasting station and began the regular broadcasting of music and entertainment. This station was then known as 8XK, the call letters assigned in the new license he carried from the Department of Commerce. The station has been fully described in the September, 1920, number of "QST," radio magazine. At first his efforts were confined to the broadcasting of phonograph music every Wednesday and Friday night. Soon his



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He broadened his activities by providing a studio in which artists, instrumental and vocal, could render selections for transmission from his radio station, a short distance away.

Mr. H. P. Davis, Vice-President of the Westinghouse Electric & Manufacturing Company, who was largely responsible for his company entering the radio field, had been watching not only the technical development of the equipment but also the attitude of the public toward broadcasting, realized the necessity of providing this service in a systematic and properly organized manner as a part of his company's business operations, and, therefore, in the fall of 1920, began the construction of a broadcasting station at the East Pittsburgh plant. Experiments were carried on for several weeks previous to election night in November, 1920, when it was intended to inaugurate this service by broadcasting the election returns. A special license was obtained from the Government radio inspector in Detroit, Michigan, and the call letters 8ZZ were assigned to the station in the beginning. The election results were startlingly satisfactory and the letters of appreciation received by the company dispersed any doubts as to the advisability of continuing broadcasting. Plans for the improvement and enlargement of the station were immediately inaugurated and regular nightly programs were announced with specially selected artists as entertainers. A wave length of 330 meters was originally assigned to this station.

It was immediately evident that suitable programs must be provided for Sundays, as the ordinary entertainment did not seem appropriate. This naturally resulted in the desire to broadcast church services, but this required additional technical development, as it was desired to transmit the complete service from the chimes to the postlude. It was therefore necessary to devise equipment which could be installed in the church, pick up the choir and congregational singing, the sermon and oral parts of the service, and amplify them sufficiently so that they could be transmitted over the telephone line without distortion. Remember, this required transmission over thirteen miles of telephone line and cable. The acoustics of most churches leave much to be desired, and this line transmitting was no simple problem. However, the enthusiasm shown by the radio audience after the first broadcasting of church services convinced the Westinghouse Company officials that they had made no mistake in attempting this feature, and they have continued it ever since in all their stations and devoted a large part of their development effort to improving this part of their broadcasting service.

Much was printed during the war regarding the radio telephone developments for our fighting forces. While many interesting developments resulted and some fundamental principles founded, there was very little practical application of radio telephony during the war, and practically none by the fighting forces. In the development work Mr. Conrad had been an active participant, and he began his broadcasting work with this war experience as a basis and used the personnel and manufacturing facilities of the Westinghouse Electric & Manufacturing Company.

When the company took up broadcasting actively they immediately provided the neces-

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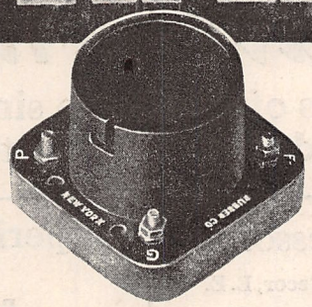

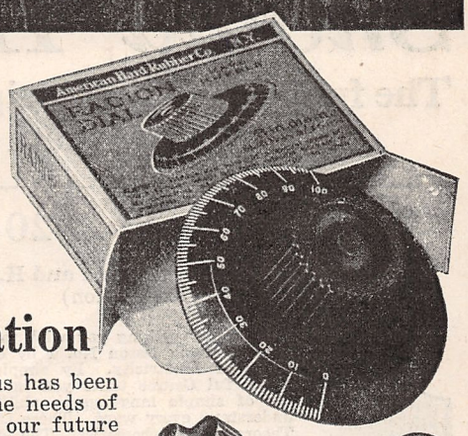

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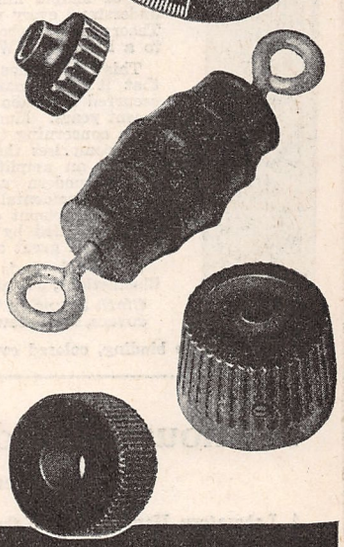

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sary funds to develop it to the utmost. It is not exaggeration to state that their station at East Pittsburgh, now known as KDKA, the matured successor to 8ZZ, has never been more than one week old in the sense that better and improved forms of equipment are continuously being provided. KDKA may, therefore, be called the father of the broadcasting activities in this country today. It is true that radio telephone broadcasting had been attempted spasmodically even previous to the war. Various experimenters had sent out music from their stations in the course of their efforts to develop radio telephony. These experiments had been with varying results as to quality, and were never maintained with any regularity or dependability, so that the war found this country without any commercial or reliable radio telephony. Wartime developments indicated the possibilities which the coming of peace made realities. During the war all commercial radio activities were suspended by Government decree. The development of KDKA since that time has just been followed.

After KDKA had been operated for nearly a year, and its practicability demonstrated, the Westinghouse Company proceeded to establish additional stations at their branch factories at Newark, N. J., and East Springfield, Mass. These were opened in the fall of 1921. With the establishment of the additional stations, the Department of Commerce had assigned a wave length of 360 meters to all the Westinghouse stations.

On November 11, 1921, Armistice Day, an anniversary of the war, which in a way was the father of broadcasting, the Westinghouse Company opened its broadcasting station located on the Commonwealth Edison Building at Chicago, Illinois. This station was opened by arrangement with the Chicago Edison Company, who desired to open it with the broadcasting of complete grand opera from the Auditorium Theatre, Chicago, which started its season the following Monday, November 14, 1921. This, as far as the writer knows, was the first case in which complete grand opera from the overture at the beginning to the final chorus was sent out by radio telephone.

Each of the Westinghouse stations covers a different section of the country, but each has been successful in arousing great interest and causing the installation of innumerable receiving stations.

Other business interests established broadcasting stations, each of which was assigned to the 360 meter wave length.

The operation of all these stations on the wave length originally assigned the Westinghouse stations had brought up a chaotic condition in the ether, which brought about the conference referred to in the beginning of this article.

It was evident that provision must be made to assign different wave lengths to the various stations, which must be classified as to range and purpose, and that limitations must be imposed as to schedule, power and area of activity. The enormous publicity given the Westinghouse Company because of its pioneer activities attracted the attention of many firms who desired to do likewise, without a realization of the time and money expended or that the greatest expense of the proper operation of such a station is the facilities necessary for the improvement and development of the equipment, such as are usually only available to a company interested in the manufacture of radio equipment. Secretary Hoover of the Department of Commerce recognized that unrestricted establishment of broadcasting stations would result in bedlam, and therefore inaugurated the movement which resulted in the committee meeting referred to in the opening of this article.

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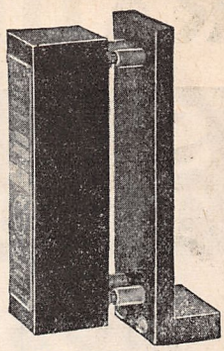

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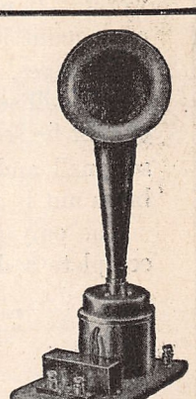

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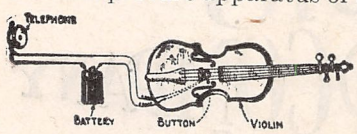

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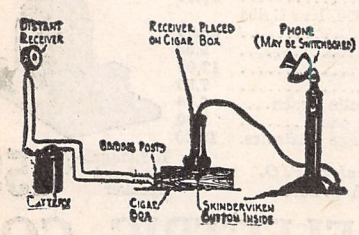

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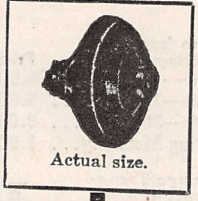

Actual size.

MR. H. Gernsback, editor of this magazine, who is the dean of electrical experimenters, said: "In the writer's opinion, obtained by actual elaborate tests, the Skinderviken Transmitter Button is probably the most efficient device of its kind on the market today, due to its simplicity and other outstanding features. Should have a great future."

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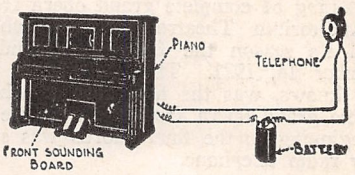
The button may be used to amplify RADIO SIGNALS by using it in a local circuit. It should be mounted on the diaphragm of a telephone receiver connected to the radio set and in circuit with a battery and a telephone induction coil. A wire should be soldered to the diaphragm to make good contact or to the case of the receiver if it is a metallic one. A low resistance phone is used in the primary circuit of the coil.



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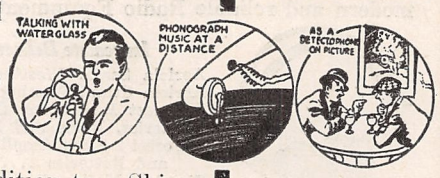

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Broadcasting has already supplemented the newspapers to a wonderful extent, and may greatly increase their activities. Its value to farmers or others living at remote points where newspaper information is not easily accessible is beyond calculation. Already the live stock and grain reports information sent out by the Department of Agriculture regarding farm projects and business has met a response indicating that this is one of the most important fields of service in radio broadcasting. Here is the means that brings the information to the radio listener even quicker than it would an auditor in audiences of ordinary size. In many parts of the Middle West the farmer is guided almost entirely by the information he obtains from the Westinghouse station at Chicago, which broadcasts every half hour quotations of the Board of Trade operations. Local brokers handle the farmers' orders which the country line telephone enables them to place upon the receipt of the guiding radio information.

President Roosevelt, during his administration, appointed a commission to endeavor to devise means to keep the farmer, in the words of the old song, "Down On the Farm." Broadcasting will accomplish more in this direction than any means yet devised. Moving pictures and the broadcasting brings cosmopolitan life into the most remote farming regions. Public health instruction is sent out from one Government station, and the function will no doubt be greatly increased.

However, in closing this article, the most important impression that we desire to leave is that unlimited broadcasting activities, instead of attaining all the objects outlined heretofore, will, rather, prevent successful attainment. Free speech does not mean that we can all talk at once, and only those with a real message can get attention. Many of us labor under the delusion that we are called and have such a message, but if we speak only in behalf of ourselves or repeat platitudes we add to the din but not to progress.

Unfortunately, the elements controlling radio limit the number of stations that can operate successfully within limited wave bands or geographical areas. The public must decide whether it shall endeavor to pick out the worthwhile message in a bedlam of broadcasting that may come with the establishment of a large number of stations or whether they prefer to limit and classify the broadcasting stations, granting them a license which will carry some of the exclusive features and advantages of a franchise and with its continuity dependent upon the maintenance of a certain standard of excellence and revocable when it is evident that the station no longer fulfills the public demands.

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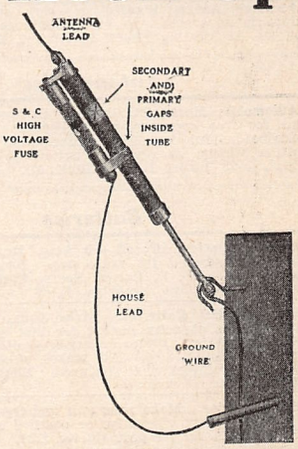

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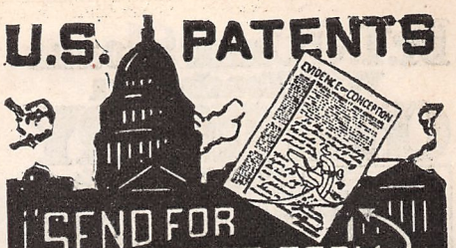

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Stop! Look! and Act! V.T.'s and accessories. Radiotron U.V. 200 detector, $5.00 each. Premium Dubilier mica grid condenser adapted to adjustable grid leak, or a Radeco safety fuse of correct size. Radiotron U.V. 200, $6.50 each, or Myers High mu audion amplifiers, $5.00 each. Premium Dubilier mica by-pass condenser. On orders for two tubes you may take your choice of either a high-grade Fada panel mounting rheostat or Fada panel mounting V.T. sockets, with bakelite base. Radio frequency amplifying transformers: Murad T-11, $6.00, R.C. of A.U.V. 1714, $6.50. Audio Frequency Transformers U.V. 712, $7.00; Federal 226W, $7.00; Thordarsen, $4.50. Myers Choke Coil, $3.50. Premiums Dubilier mica By-pass condensers. Immediate delivery or remittance returned. Postpaid and insured. The Kehler Radio Laboratories, Dept. R1, Abilene, Kan.

Variable Condenser Plate, 3c.; stationary washer, 5c. doz.; movable, 10c. doz.; shaft, 25c.; rods, 5c. top and bottom 25c.; paid. Parts for 23 plate, $1.50; 43, $2.50. Gravenstede, 84 Hancock Ave., Jersey City, N. J.

Guaranteed quality products at right prices. Large size Variometers, grid or plate, polished blocks, natural, brown or red finishes, heavy hardware poplar, $3.50; solid mahogany, $4.00. Variocouplers, 8 taps, fiber tube, $2.50. Bakelite tube, $3.00. Rigid type variable condensers, no washers to loosen, plates swedged in heavy solid brass rod, 11 plate, $3.25; 21 plate, $3.50; 41 plate, $4.00. Amplifying transformers, 1-9, $3.50; 1-3, $3.25. We carry a full line of tubings, electric wires and insulations. Coils and parts wound or built to order. Wood turnings and machine parts to order. Special proposition to dealers, manufacturers and those buying in quantities. Agents and representatives wanted. All products guaranteed. Send for manufacturers' complete list. McConnell Cable and Specialty Co., 426 South Clinton St., Chicago, Ill.

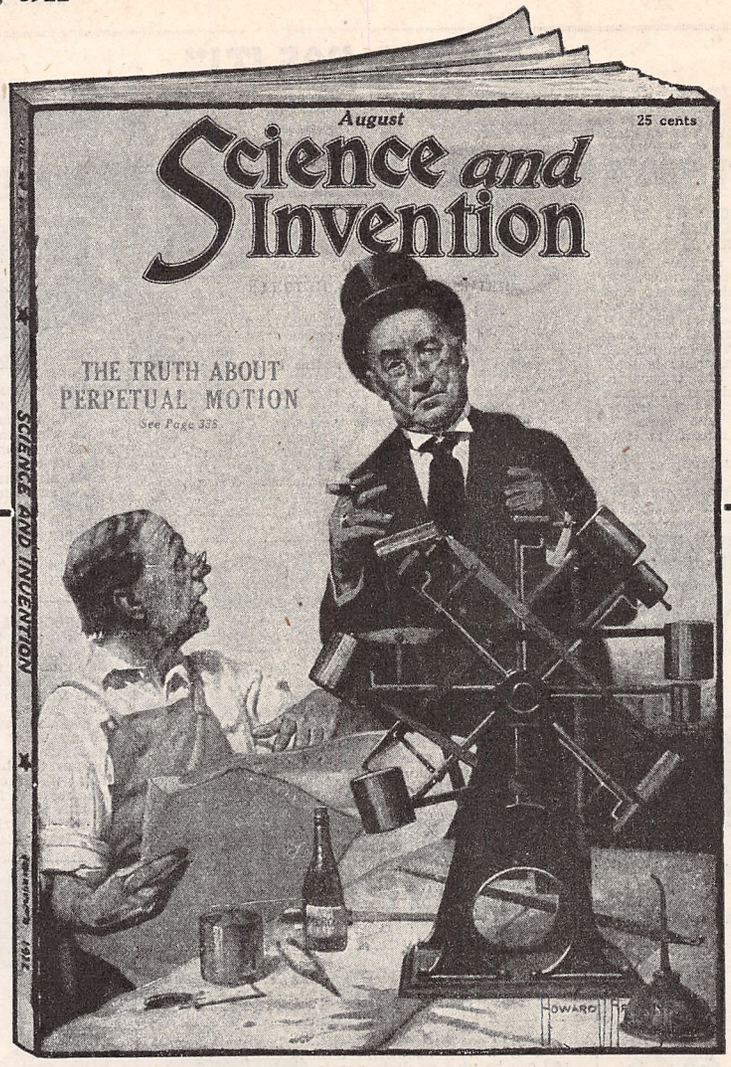
Bargains: Variometers, $3.00. Variocouplers, $3.00. Two Variometers and variocoupler, $8.00. Wound with silk wire. Galena, 17c. Unmounted tuning coils beautifully finished, 95c. Dials, 50c while they last. K. J. Morrison, Box 1396, Pittsburgh, Pa.

Wireless Course in 20 Lessons. By S. Gernsback, A. Lescarboura and H. W. Secor, E. E. Tells you everything you want to know about "Wireless"—theory, practice and history. A clear, concise course on every phase of this subject. 160 pages—350 illustrations, 30 tables. Stiff cloth cover, $1.75 postpaid. Experimenter Publishing Co., Book Dept., 53 Park Place, New York.

How to Make Wireless Receiving Apparatus. 100 pages—90 illustrations. Only strictly modern radio apparatus are described in this book and the illustrations and descriptions are so clear and simple that no trouble will be experienced in making the instruments. Paper covered, 35c postpaid. Experimenter Publishing Co., Book Dept., 53 Park Place, New York City.

How to Make Wireless Sending Apparatus.—100 pages—88 illustrations. Written and published entirely for the wireless enthusiast who wants to make his own radio apparatus. Contains more information on "how to make it" than any other book we know of. Paper bound, 35c. postpaid. Experimenter Publishing Co., Book Dept., 53 Park Place, New York City.

The How and Why of Radio Apparatus, by H. W. Secor, E. E. This newest book on radio matters fulfills a distinct gap in wireless literature in that, while the treatment is made as understandable and as free from mathematics as possible, it at the same time incorporates a wealth of technique and instruction for the Radio Amateur—the Radio Operator—the Installation and Designing Expert—as well as teachers and students of the subject in general. A very broad field has been covered by the author, at the same time giving a great deal of information not found in other text books. If you are engaged in any branch of the Radio or allied arts at all you will surely need this latest contribution to radio literature, which is destined to be found on every radio man's book shelf before long. A glance at the following list of chapters gives but a very scant idea of the extensive and useful radio knowledge provided in its text: The Induction Coil; The Alternating Current Transformer; Radio Transmitting Condensers; The Spark Gaps; Radio-Transmitting Inductances; Radio Receiving Tuners; Radio Receiving Condensers; Detectors; Telephone Receivers; Radio Amplifiers; Construction of a Direct Reading Wavemeter and Decremeter; Antenna Construction; The Calculation and Measurement of Inductances; Appendix containing very useful tables, covering all subjects treated in this very unusual book. This newest of Radio Works, cloth bound in Vellum de Luxe, Gold Stamped and Hand Sewed, has 160 pages. Size of book 6x9 inches. The How and Why of Radio Apparatus. Postpaid, $1.75. Experimenter Publishing Co., Book Dept., 53 Park Place, New York City.



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Some of the Radio Articles in the August Issue

Movies Actually Sent via Radio. Marconi Explains Directional Radio. Radio Telephone and Aircraft. New Radio Loud-Speaker and Power Amplifier. Radio Set in a Table Lamp. The Detectorium. Radio for the Beginner. No. 6—How to Get More Sound Out of the Radio Receiver.

SCIENCE AND INVENTION is just chock full of interesting articles and illustrations that appeal to everyone. It will hold your interest from cover to cover because it contains everything new in the field of science, invention and mechanics. Quoted by hundreds of newspapers and magazines all over the world every month.

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Partial Contents for August, 1922

POPULAR SCIENTIFIC ARTICLES
Perpetual Motion?
Editorial
Compressed Air and Vacuum Railway
Forgery-proof Checks
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Firing Ice Bullets Into Soil
How I Hypnotize Animals
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The Truth About Perpetual Motion
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Seaplaning From Florida in Record Time
The Eyes of Plants
Truth Enforced by Machine
Tone Producer for String Musical Instruments
Tony Sarg's Marionettes
New "Cold Light" for Movies
What Is Paper Made Of?
Could You Answer These Questions?

PRIZE CONTESTS
The Truth About Perpetual Motion—$150.00 in Prizes
Motor Hints—$50.00 in Prizes for Your Ideas
Prize Winners in "Bent Wire" Contest
How-to-Make-It Department—$30.00 in Prizes
Wrinkles, Recipes and Formulas—$5.00 Monthly Prize
Description of Set of Fourth Prize Winner in $300.00 Radio Receiving Set Contest
How to Make a Loud-Talker—Five Prizes Totaling $100.00

AUTOMOBILES
Seaplane and Automobile Running Time from Florida to New York
Motor Hints—$50.00 Prize Contest

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Sky Billboards of To-morrow—A New Role for Searchlights
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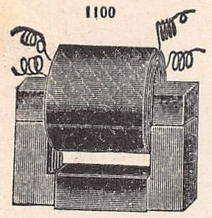

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We have compared many of the present transformers on the market but have finally decided upon a type that is the most efficient one we have seen so far. The best amplifying transformer is that in which the impedance of its primary is equal to or exceeds the impedance of the plate-to-filament circuit of the tube in which it is connected.

We guarantee this transformer to equal any one on the market.

No. 1100 "Rasco" Audio Frequency Transformer **(not assembled) each prepaid**.....$2.65

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This antenna connector is made entirely of aluminum, is light and will not rust. The only connector of its kind. The 4 antenna wires go to the upper holes; the lower hole takes the lead-in. Don't solder your aerial, don't have loose connections. Dimensions 2" high, 1¾" wide, 5/8" thick.

No. 999, Connector, each..$0.35

999

PANEL KNOBS

6241

838

No. 6241 is well made and has a good corrugation. Its dia. is 1", height is ½", hole 5/32". The shank is ¼" high.

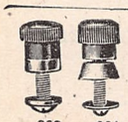
No. 6241, Knob, each.....$0.08

MARCONI KNOB

Has a central hole of 5/32" and seat to hold the screw. dia. is 1¼", height ¾".

No. 838, Marconi Knob, each.....$0.15

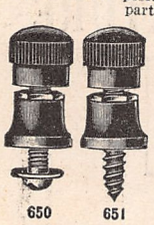
RASCO POSTS



202 201

030 029

These are our very own patterns, from our own designs and look mighty handsome on any instrument. The top knobs are of composition, the bottom parts brass nickel plated polish.



650 651

No. 202 is nickel plated at bottom part.

"Rasco" Binding Post, 8/32 thread, each, $0.10; doz., $1.00.

No. 202, Post, each, ...$0.08

Nos. 650 and **651** made entirely in composition with a hexagonal brass nut in center.

No. 650 has 8/32 machine screw.

No. 651 has bottom wood screw.

No. 650, Post, each.....$0.08

No. 651, Post, each.....$0.08

Dozen, each style.....$0.90

BRASS NICKEL POSTS

No. 029, Binding Post, each.....$0.05

No. 030, Binding Post, each.....$0.04

75 1 2 3 4 5 6 7 77 76

RASCO SWITCH POINTS

Nickel plated and polished. The following have been found the most popular.

No. 1 ¼"x¼", 6/32 thread, ea., $0.03; doz., 35c

No. 2, 3/16" high, ¼" dia., 6/32 thread, ea., $0.03; doz., 35c.

No. 3, 3/16" x 3/16", 4-36 thread, ea., $0.03; doz., 35c.

No. 4, ¼" dia.; ⅛" thick; stem 6/32, ea., $0.03½; doz., 40c

No. 5, ¼" dia., 3/16" thick; stem 4-36, ea., $0.03½; doz., 40c

No. 6, 3/16" dia.; 3/16" thick; stem 4-36, ea., $0.03½; doz., 40c.

No. 7, 3/16" dia.; ⅛" thick; stem 4-36, ea., $0.03½; doz., 40c.

No. 75, Switch Stop, ⅞" long, 4-36 thread, complete with nut, ea., $0.05; doz., 50c.

No. 76, New style Switch Point, to be pressed into bakelite panels with forced fit. Wire is soldered to pin end. Head ¼"; dia., 1/16" thick, ea., $0.03½; doz., 40c.

No. 77, same as above, but head is ¼" dia. x 3/16" thick, ea., $0.03½, doz., 40c.

1898

THE RASCO BABY DETECTOR

In presenting this little Detector, we feel sure that it fills a place never taken before by any small detector. It does a variety of things and does them all well and better than many $5.00 detectors. The base is solid, black composition. Mounted on same is a nickel holder and binding post which holds a flutted hard rubber knob with its sliding rod member.

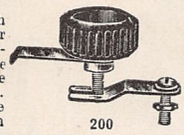
The outstanding part of the Detector, is the patented nickel detector cup and binding post. The knurled cap unscrews and you place the Galena Crystal in the cup, then replace the knurled cap and the galena crystal is held secure. The circular hole in the cap exposes enough of the crystal for ordinary purposes.

No. 1898, Rasco Baby Galena Detector. Price, prepaid.....$0.50

No. 1899, Rasco Baby Detector with Galena and Radiocite Crystals. Price, prepaid.....$0.75

PANEL SWITCH LEVER

New style switch lever with lock fork. It is impossible for this lever not to make positive contact at all times. The blade radius is 1¼". Blade is nickel plated and polished. Fork is phosphor bronze. The lock fork holds the screw (in which it rotates), securely. A loose contact is impossible.



200

No. 200, Switch Lever, complete as illustrated..$0.30

LITZ WIRE

323

This wire is recognized as the only thing for winding coils for Radio instruments. Particularly recommended with our **No. 343** Variocoupler Rotor, for vario-couplers, banked windings, etc.

No. 323, Litz Wire, 20 No. 38 strands, enameled double silk wire, per foot, $0.02; per 100 feet, $1.15

No. 890, Litz Wire, 10 strands No. 38 wire, per foot, $0.01; per 100 feet, $0.75.

No. 891, Litz Wire, 16 cables of three strands No. 38 wire, per foot, $0.03; per 100 feet, $2.25.

NOTE: This page contains only a few of our 300 specialties.

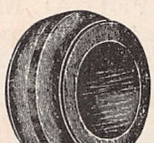
PANEL KNOB

This is a very distinctive knob and can be used on dials, panels, switches, condensers, etc. It is exceptional and well made. Dia. 1 1/16"; height 11/16"; comes with 8/32" bushing.

No. 815, Knob, each.....$0.18

815

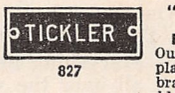
VARIOCOUPLER ROTOR



343

This rotor is used by all up-to-date amateurs. Is accurately turned of hard wood and is used as a secondary coil. It takes any finish, either shellac or stain and can be drilled readily for any size hole. Large hole 2" dia. Width of spool is 2". Total dia. 3⅜".

No. 343 Variocoupler Rotor, each $0.75



827

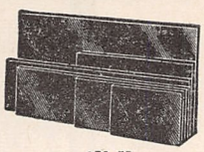
"RASCO" NAME PLATES

839

Our name plates are of brass with a black background. Letters are polished nickel. Order by name and number.

	Each		Each
807 "Phones"	$0.05	810 "Ground	$0.05
809 "Aerial"	$0.05	812 "Primary"	$0.05
811 "Secondary"	$0.05	814 "Detector"	$0.05
813 "Audion"	$0.05	866 "On"	$0.05
865 "Off"	$0.05	840 "Increase Current" (Left)	$0.10
839 "Increase Current (Right)	$0.10	834 "Series"	$0.05
813 "Vacuum Tube"	$0.05	830 "Receive"	$0.05
831 "Transmit	$0.05	820 "2nd Step"	$0.05
821 "3rd Step"	$0.0	827 "Tickler"	$0.05
819 "1st Step"	$0.05	825 "Plate Variometer"	$0.05
826 "Grid Variometer"	0.05	835 "B Battery"	$0.05
823 "Secondary"	$0.05	817 "Output"	$0.05
836 "A Battery"	$0.05	824 "Primary Condenser"	$0.05
818 "Input"	$0.05	828 "Parallel"	$0.05
829 "Telephone"	$0.05	837 "+ —"	$0.05
833 "Detector Tube"	$0.05	841 "(Blank)" (takes pen or pencil writing)	$0.05
822 "Coupling"	$0.05		
808 "Load'g Coil	$0.05		

Price of all of our name plates in dozen lots, 50c, with the exception of the two "Increase Current"



350-55

BAKELITE PANELS

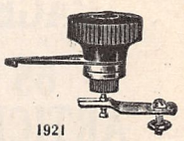
We list below six panels, the sizes of which have been selected after carefully checking up many dimensions of the most popular radio apparatus on the market.

Note particularly that our prices are anywhere from 25 to 50% lower than those quoted by most other concerns. The reason is that we buy these panels in very large quantities, **and we do not cut sheets to order.** Remember always that when sheets are cut to order they cost you at least 50% more than our prices, because **you must pay for the cutting and the necessary waste.**

Note also that we ship these panels prepaid. This alone amounts to a considerable saving.

No. 350	6"	x 12"	x 3/16"	thick,	each	$1.90
No. 351	6"	x 18"	x 3/16"	"	"	2.85
No. 352	9"	x 12"	x 3/16"	"	"	3.00
No. 353	12"	x 18"	x 3/16"	"	"	5.65
No. 354	6½"	x 19½"	x 3/16"	"	"	3.50
No. 355	6"	x 7½"	x 3/16"	"	"	1.20

"RASCO" LUBRICATED PANEL SWITCH

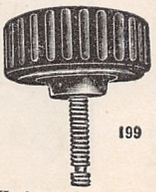


1921

A radio switch that has two nuts at the end is a monstrosity, for the reason that it will never stay put. Our patent spring fork holds the switch handle always under uniform tension, at the same time it insures the best contact possible. **New wiping contact**, which covers every point of the switch point. Another new improvement is the lock fork, which can assume three different positions to accommodate the switch to various thicknesses of panels.

No. 1921 "Rasco" Switch, as illustrated, each **$0.50.**

KNOBS



199

4451

These knobs are favorites with all experimenters The size of both is: dia. 1⅛", height ⅝". No. 4451 comes with 8/32 and 10/32 bushing.

No. 4451, Knob, each...$0.06

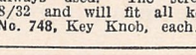
No. 199 (screw length ⅝") Knob, each $0.10

NAVY KEY KNOB

748

This navy key knob is now used on all standard wireless keys. It gives the right swinging mation and rests the fingers. It is a favorite with all advanced amateurs. Once used always used. The screw is 8/32 and will fit all keys.

No. 748, Key Knob, each.....$0.28



8032

THREADED BRASS ROD

We carry two styles, 6/32 and 8/32 thread. **Only 6" lengths sold. No others.**

No. 8032, Threaded Brass Rod 8/32 thread, per 6" length $0.08

No. 6032, Threaded Brass Rod, 6/32 thread, per 6" length $0.06

THE "RASCO" CATALOG

CONTAINS 50 VACUUM TUBE HOOK-UPS

Complete hook-ups of all important vacuum tube circuits are given in clear diagrams with complete explanation. Just to name a few.—The V.T. as a detector and one-step amplifier; regenerative circuit; De Forest ultraudion; V.T. to receive undamped and spark signals; Armstrong circuits; one step radio frequency amplifier and detector; three stage audio-frequency amplifier; short wave regenerative circuits; V.T. radio telephone; 4-stage radio frequency amplifiers; radio and audio frequency amplifier, inductively coupled amplifier; Armstrong superautodyne; radio frequency amplifier and crystal detector; etc., etc. The catalog contains 200 illustrations. On account of its great cost, it cannot be distributed free of charge. Mailed only upon receipt of

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Here is your greatest opportunity for fortune and success. Take advantage of it. Radio needs YOU NOW! Get into this fascinating profession. The field is uncrowded. Jobs are literally going begging for competent trained men. The pay is big, and the work fascinatingly easy.

"Cash In" On Your Knowledge

Don't be a stay-behind. Don't let the other fellow beat you to the wonderful positions now waiting for you in Radio. Make Radio a profession—not a plaything. Don't let your Radio-knowledge go to waste. "Cash in" on it—*Big!*

Thousands of men with no knowledge or experience now are preparing for wonderful careers in this great profession. Will you allow these beginners to get ahead of you? Will you let them get all the big jobs while you sit idly by? Will you always be satisfied with being just an extra good amateur when it is so easy to earn big money as a professional Radio-trician?

"Radio Headquarters" Will Help You

The knowledge you have now of Radio operation and maintenance makes it easy for you to train yourself and obtain a wonderful position paying as high as $10,000 a year. If you are attracted by the adventure and excitement of travel, Radio offers you a glorious opportunity to see the four corners of the earth, with all expenses paid and a fine salary besides, or you can stay at home and take one of the fine positions all around you.

Use your present Radio experience to help you achieve a wonderful success in this great field. America's "Radio Headquarters," the National Radio Institute, has devised an amazing new plan that will complete your Radio education in spare time at home, and enable you to qualify for a Government Commercial operator's license so you can take your place in the Radio profession in the shortest possible time.

One of the features of this remarkable course, which is approved by the Government, is that you are furnished free with four wonderful instruments for practical work at home. Among them is the wonderful Natrometer, which quickly helps you acquire expert speed and accuracy in sending and receiving code.

In addition to this splendid, simplified short-cut course and the four patented instruments, nationally known Radio experts are your instructors. They correct your papers, give you the advice you seek, help you in every way with their wide experience to become a successful Certified Radio-trician.

What an electrical engineer is in electricity a Certified Radio-trician is in Radio.

The National Radio Institute Can Help You As It Helped These Men

N. R. I. Graduate a Radio Engineer

I believe your course in Radio Telegraphy and Telephony operation to be the best and most complete on the market today. I feel more than confident that any student taking your course and applying himself should have no trouble in passing the government examination. I, myself, am a graduate of your school.
R. J. DAUGHERTY, Radio Engineer,
Hamilton, Ohio

No Course More Complete

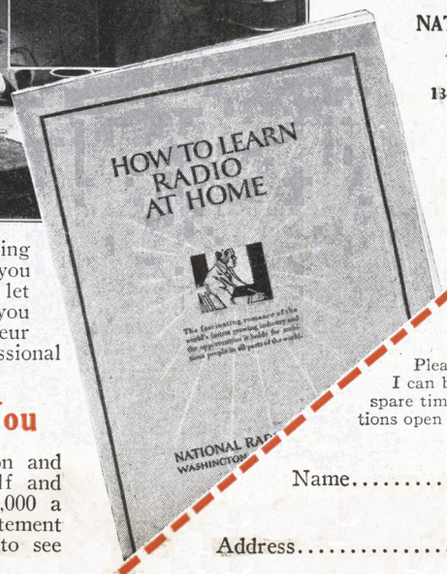
No course could be more complete, more clear to the beginner. Besides giving a comprehensive study in Radio, the N. R. I. course practically covers every branch of electrical phenomena. An N. R. I. graduate has a wide and useful knowledge that cannot but be of use to him in any line of electrical work. NELSON V. LLOYD,
Ralston, Washington.

Easy to Get Good Job

Only a short letter to let you know that I am still on board and waiting for the ship to sail. Tell your students for me that a man with a license has no trouble obtaining a good position. Believe me, a job like this is worth a good deal of studying. L. M. WARING, JR.,
S. S. "Lake Farney,"
Norfolk, Va.

Course Superior to Others

I will say that the training I received from you and the careful instructions have enabled me to thoroughly understand Radio. The Natrometer is a great help to one who wishes to receive the code fast. The course is superior by far to any other that I know.
PHILIP PAUDIER,
9 Archer St.,
Lawrence,
Mass.



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The National Radio Institute is ready to give you the same practical help that has put hundreds of its graduates on the highway of Radio success. Read the letters in the panel from just a few of our 8,000 students and graduates. You have the basic knowledge now. Just a part of your spare time spent in learning the *professional* side of Radio will qualify you for your career in this field of unparalleled opportunities.

Radio is paying enormous earnings to men all over the country today—it is making hundreds of men wealthy. Find out at once about *your* opportunity in Radio. Send for the interesting big Book which tells all about the future waiting for you in this great field, and gives complete details of the plan by which the National Radio Institute prepares you quickly in your spare time to become an expert Radio-trician and helps you through its Free Employment Service to a good Radio position. Mail the coupon, or write a letter NOW!

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